THE JOURNAL OF GAS LIGHTING
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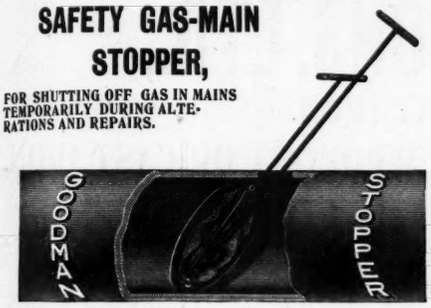

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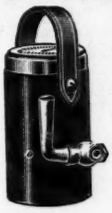

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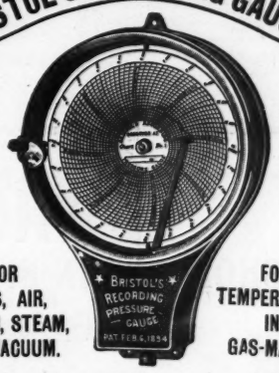

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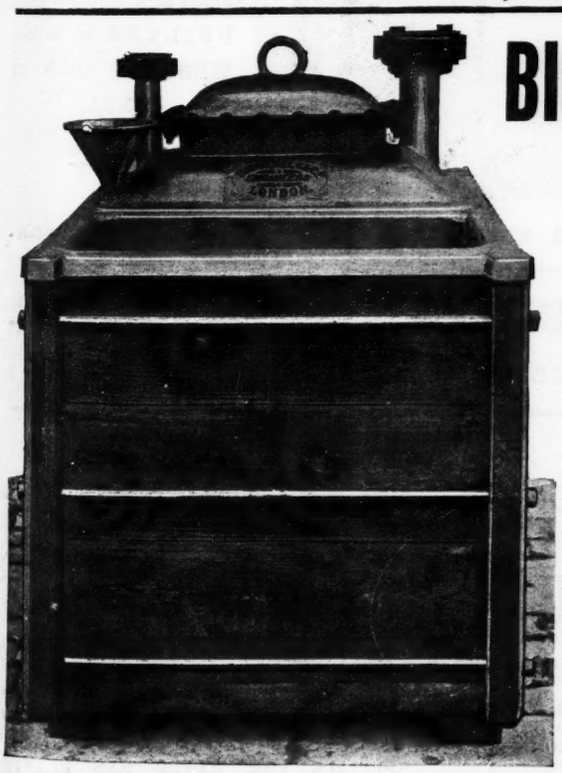

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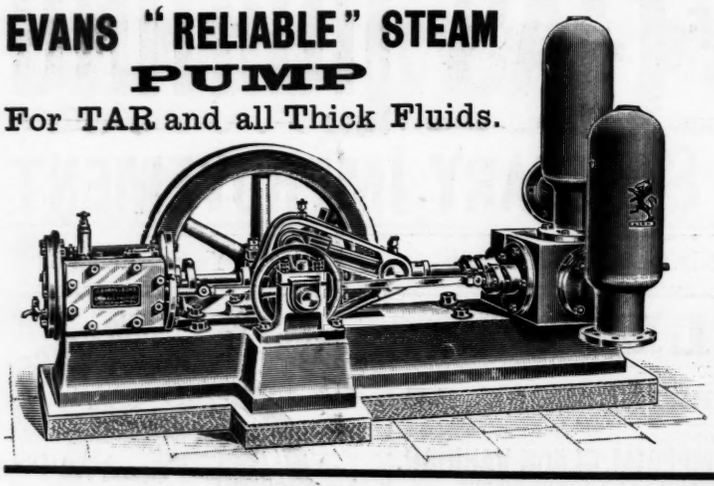

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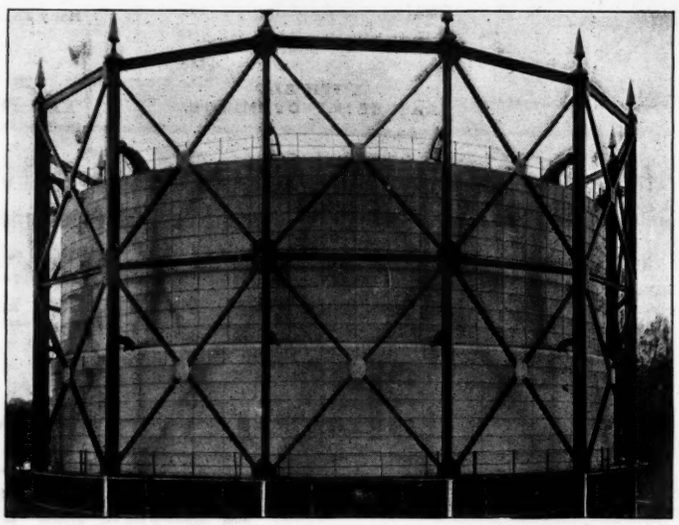

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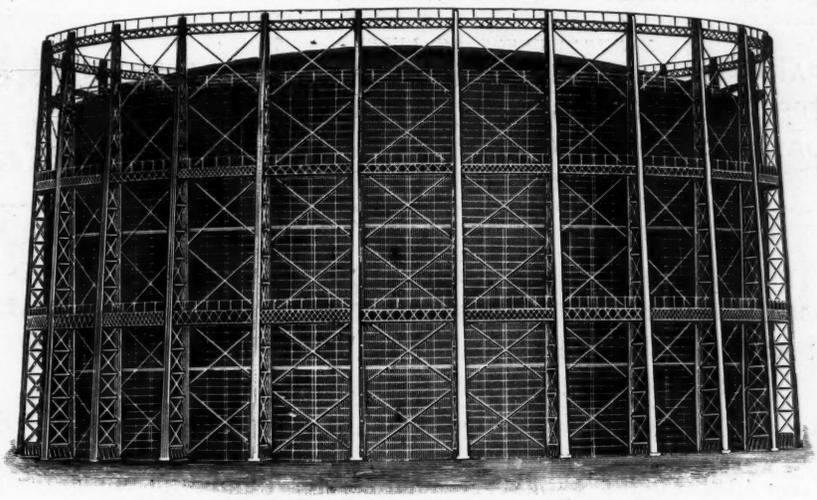

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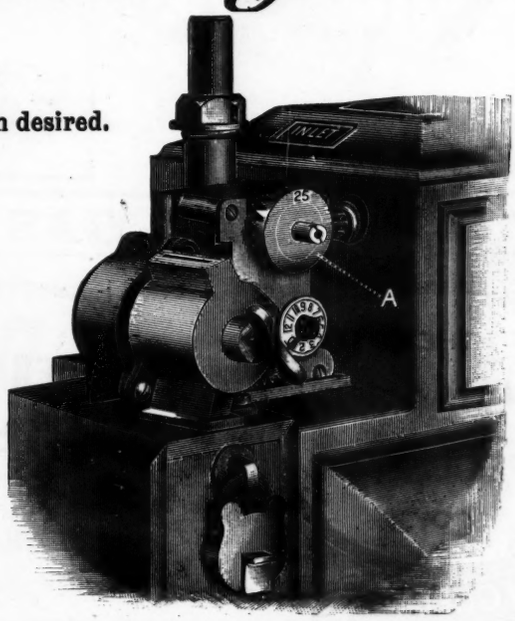

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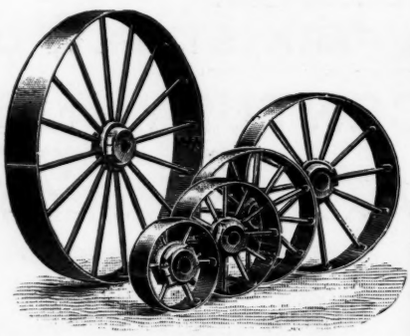

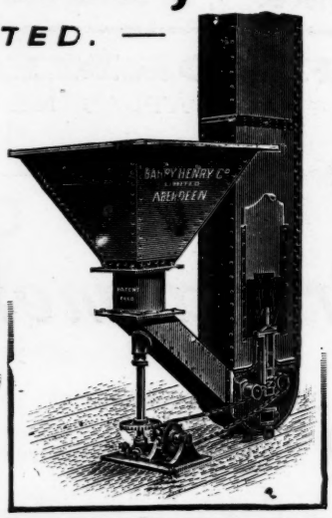

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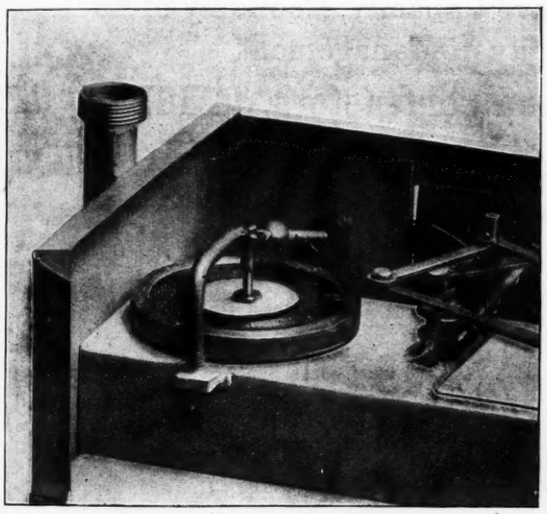

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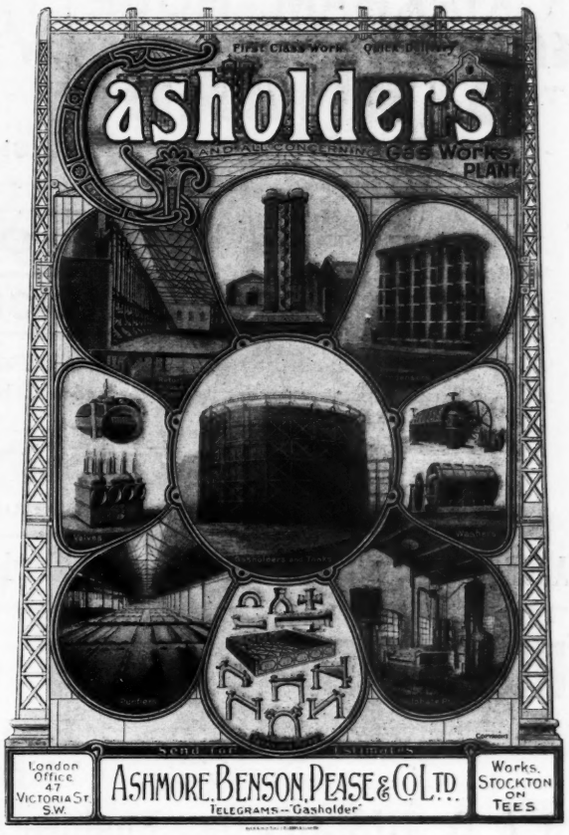

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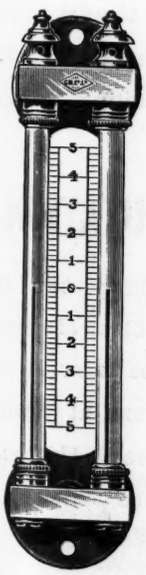

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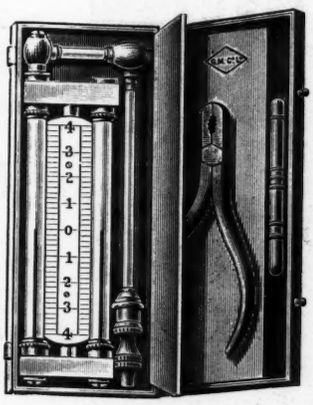

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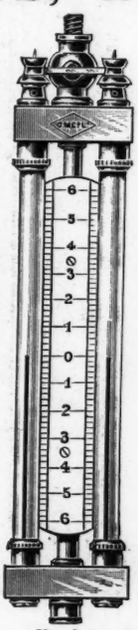

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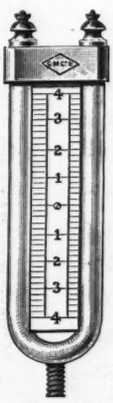

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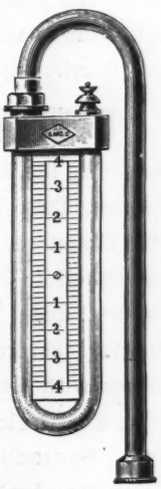

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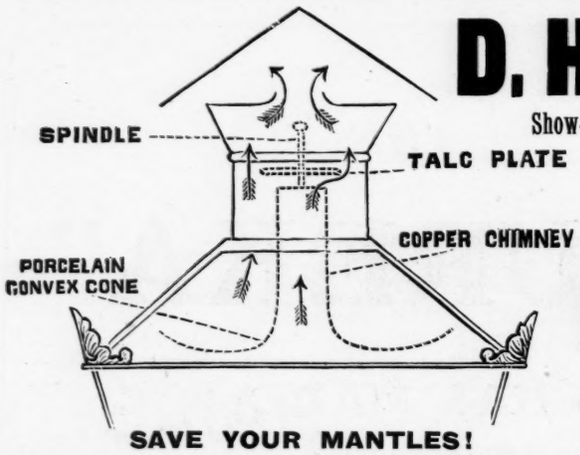

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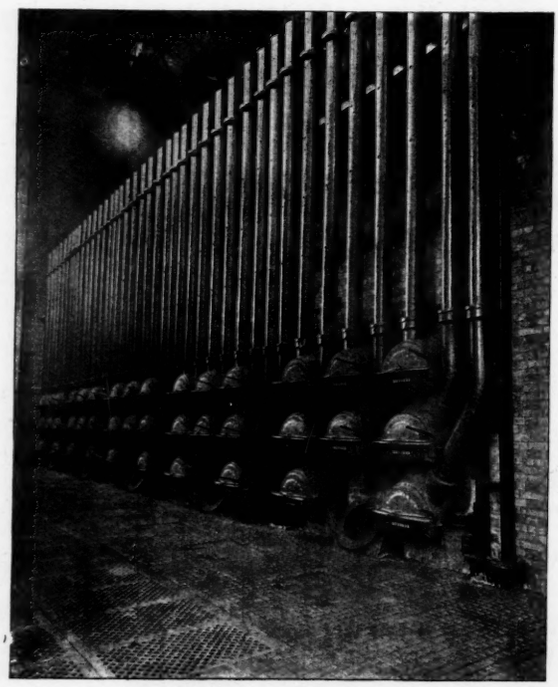

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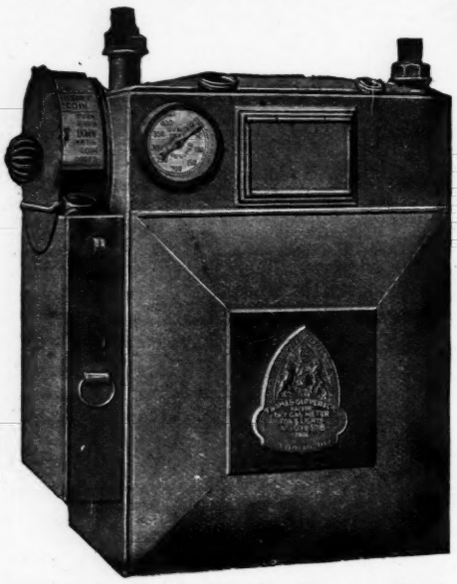

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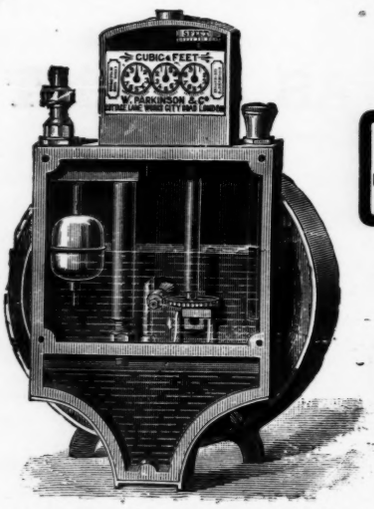

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EDITORIAL NOTES—GAS, &c.

The Institution Programme And the Gas-Test Absurdity.

THERE is now before us the provisional programme for the annual meeting of the Institution of Gas Engineers, which commences on Tuesday, the 30th of May, and will continue over the two succeeding days in London; terminating on the Friday with a visit to the large new Glyne Gap works of the Hastings and St. Leonards Gas Company, which have been designed and erected by Mr. C. E. Botley, assisted by his son, Mr. C. F. Botley. Upon the programme for the meeting, there will be a round of congratulation to the President (Mr. D. Irving) and the Council; for every one of the contributors to the technical portion of the proceedings has such a marked individuality, and all their compositions are to have for material the results of personal study or experiences, that there is promise of a splendid accumulation of fact and opinion and a brilliance in discussion which, if equalled, will not, we confidently anticipate the result will show, have been exceeded at any previous annual gathering. Certain of the subjects are of a particularly controversial nature; and they are brought into the arena by combatants who, it will be recognized, are certainly qualified to sustain their defence.

Papers dealing with manufacturing operations are distinguished by a majority. Mr. John Bond has pledged himself to one on "Pyrometers and Carbonization;" and possibly he will tell his hearers how stricter attention to the subject and practice of pyrometry will conduce to a greater uniformity of heats and consequently to a greater uniformity of product. It is now well known (and some additional information will be found on p. 153) that Mr. J. H. Brown has been prosecuting at Nottingham some important researches with "Low-Grade Mixed Gases;" and the quoted words are the title of a paper for which he has engaged himself for this meeting. There is current interest about the subject, and freshness and completeness surround the author's experiments. The paper is bound to command universal attention; more especially as in it is possibly enveloped (so events may disclose) the foundation of the future policy at Nottingham in regard to the character of its gas supply. To keep manufacturing topics together, it will be noted by the detractors of the inclined system generally and of the Granton installation in particular, that Mr. W. R. Herring is going to give them a fair opportunity for a little exercise by meeting him on the subject of "The Manufacturing Costs at "Granton." The length and range of experience of Mr. Alexander Wilson in the working of "Outside Producers" applied to the heating of retort-benches at Glasgow, and on an extensive scale at Provan, eminently fits him for dealing with this subject, and for adding to the sum of general knowledge thereon. His appearance with this paper will bring to the mind of those who hear it, the pioneer work of Mr. William Foulis in this particular sphere of carbonizing operation. Mr. A. Doig Gibb has promised a contribution on "Structural Engineering;" and as this is a matter that has for some time past been engaging, in a very material manner, his professional energies at Newcastle, we may look for some new light on an old subject.

Upon the pressing importance of the subject of the paper by Mr. Charles Carpenter—"Testing Gas in the Metropolis, "arising out of the Board of Trade Departmental Com- "mittee's Report"—we need not dilate on this occasion. Its discussion will give everybody an opportunity for airing his views; but let no one commit the error, through the form of title given to the paper, of regarding the subject as a purely Metropolitan one. It is nothing of the kind. The new prescription for the testing of gas of under 16-candle illuminating power is a menace to the future of the entire gas industry. Then, "Incandescent Gas Lighting for Railway "Trains and Motors," is to be handled by a no less authority upon the lighting of our great railway systems than Mr. E. C. Riley. It will be a matter of especial pleasure to the members to find that the Council have been able to persuade Professor Arthur Smithells to break through his reserve, and to deliver a lecture on "The Temperature of Flame"—a subject to which he is strongly attached. And who can wonder when it is remembered that he studied in the laboratory of that great *savant* Bunsen at Heidelberg, and had Welsbach for his contemporary? For Professor Smithells, there will be the warmest of welcomes from the gas engineers who will assemble in great number to hear his lecture.

Though the programme embraces subjects of first-rate importance, it will be remarked that, unless hereafter additions are made, the commercial side of the gas business will not, at this meeting, receive particular attention. But, with the President's Inaugural Address, the lecture, and the collection of papers already referred to, there will be an abundance of material to fully engage the members during the time given up to the sittings over the three days; and therefore we think the general hope will be that there will not be any expansion of the programme in this respect. Better it is to have ample time for the thorough consideration of a few papers, than to have such a liberal supply that on the last day both the authors and the papers receive treatment of a somewhat ignominious kind which has not been without example on more occasions than one. Connected with the subject of papers, it may be mentioned that the design of the "London Medal," which is in future to be awarded to the providers of communications of distinction, and for which (or rather for the gold one) Mr. H. E. Jones has made himself responsible for a period of seven years, has been determined upon; and we have the gratification of reproducing photographs of both the obverse and reverse sides of the medal on another page.

Touching upon the paper to be read by Mr. Carpenter, it may be stated that, at the Council meeting last Friday, the Special Committee who have been dealing with the question of making representation to the Board of Trade regarding the dissatisfaction which exists in the gas industry over the deplorable method proposed for testing 14-candle and other low illuminating power gas, were instructed to again approach the Board of Trade to ascertain whether they would be prepared to receive a deputation on the subject, or, failing that, to consider a memorial setting forth the objection to the test as defined by the London County Council Bill. This measure will very soon be in the Lords; and strenuous efforts must be made to prevent the mischievous proposal receiving the final imprimatur of Parliament this session. The Special Committee will therefore make an immediate move; and the members of the Institution will, we are confident, endorse their action. For certain it is, if the test as it stands in the County Council Bill passes through the House of Lords, the more difficult will it be to destroy it in the future. Sir George Livesey has great faith that the Institution will support him, and those who are working with him, in this matter; and he is sanguine that, operating together, they will show the authorities and the Board of Trade that the gas industry intends to have fair play. If the test is not modified in the Lords this year (it is sincerely hoped that right will succeed), the South Metropolitan Gas Company, at all events, will not respect any such legalized injustice; and there will be no enrichment on their part to evade the consequences of the vicious test. Penalties will not deter them contesting step by step the injustice; and, if success is not attained this session, that of next year will find the Company in Parliament again with a Bill to repeal the obnoxious prescription, and to obtain a sane definition of the measure of their obligation to authority and the public in respect of the illuminating power of their gas. The question belongs to the gas industry; and therefore we hope that in every way possible the industry will support those who have taken the lead in this momentous matter, and who are bearing the brunt of the collision with forces directed by blindness and folly.

Commerce and Gasholder Construction at the Eastern Counties Meeting.

THE hospitable arms of Leighton Buzzard were opened to the members of the Eastern Counties Gas Managers' Association on Thursday last; and how well useful work and pleasure can be combined by men engaged in the complex duties of gas management received excellent illustration. The position of the chief official of a gas undertaking demands that he shall be an exemplar of discipline, and this, and the varied nature of duties and experiences which his work involves, enables him to accommodate himself, with perfect ease, to the circumstances of the time whatever they may be. In this is found a notable feature of these periodical outings. The complaisance on Thursday of the Chairman of the Leighton Buzzard Gas Company (Mr. R. Richmond), of his co-Directors, and last but by no means least of the Engineer and Secretary (Mr. C. F. Ruggles), together with the graceful act of Mr. Leopold de Rothschild in throwing open his superb grounds to the inspection of the members, will be stored among the most pleasant recollections produced by this combination of the gas fraternity in the Eastern Counties district; while, on the other hand, the two papers read and discussed at the meeting—the one by Mr. R. G. Shadbolt on "The Commercial Aspect of Technical "Societies," and the other by Mr. W. D. Child on "Gas-"holders and Tanks: Notes and Queries"—furnished excellent material for future consideration by all engaged in the management and constructive work of a gas undertaking. In whatever direction the gas manager and engineer operates, his work has for its single object the securing of the utmost financial benefit for the undertaking, and through it for the shareholders and the consumers of his principal commodity. Mr. Shadbolt preached the doctrine of unity and of mutual confidence among producers occupying positions which cannot, through determinate territorial restriction in manufacturing operation and in one respect of supply, be subject stringently to the ordinary laws of commerce and competition if the common interest is to be consulted. The result of the unity and confidence is the destruction of a system of cutting competition in residual products, and the obviating of a wasteful system of distribution, which, the accretion of experience so far indicates, would largely redound to financial benefit. Mr. Child's paper, on the other hand, presented a page from his experience to show how, in the matter of gasholder construction, capital expenditure might be economized; the end again being the financial benefit of the undertaking. In these two extremes of the work of a gas manager and engineer—as salesman, as constructor—is seen a uniting link.

Turning first of all to Mr. Shadbolt's paper, the immense growth of the gas industry which has succeeded the opening up of new and previously little explored regions of great fertility, has, as a natural result, brought in its train a proportionate increase in the outpourings of the saleable residual products; and the problem of the absorption of the increases has become a more acute one for many of the producers than in olden time, with a consequent keener competition. But, for the moment, regarding this problem from the purely abstract side of economy, it is a question for consideration whether, taking the industry as a whole, it is securing the utmost profit from its bye-products by the competition, and whether, by some system of regulation or of co-operation, there might not be money saved to the industry which is now spent in what appears in numerous cases to be a wasteful distribution and disposal. Coke, for instance, is now sent into a district where coke is on the spot already for sale. The ignorance of the local manager of what others are doing puts into the pockets of the railway companies shillings per ton, and the consumer is perhaps saved pence per ton. There is a loss to the industry of those shillings and pence on each ton; and not only so, but the local gas undertaking further loses by having to reduce its price to meet the competition. This is a case where the strong undertakings, consulting only their individual interests in obtaining new outlets for the coke produced upon their works, bring oppression on the weak. We acknowledge that they cannot be blamed; and it is inevitable that supplies which cannot be absorbed in a district must go where there is the demand. But need the waste, the loss, or whatever one chooses to call it, that now goes on, be so great as it is; and is there a remedy for it?

That is the point Mr. Shadbolt discusses in his paper; and he says that something can, not may possibly, be done (for it has gone beyond the tentative stage in the Manchester District Institution and the northern part of the Eastern Counties district) through an extension of the work of the District Associations from being only channels for the discussion of technical and gas-trading topics—to which by nothing more than tacit consent the work has been confined—to centres for the collection of information, and its circulation weekly among contributing members, on the important subjects of ruling prices and stocks of residual products. The advantage has been proved, in one or two districts, by small undertakings, of pooling their surplus stocks of residuals in order to better bargain for their disposal; and in Lancashire and Yorkshire the operations of the Commercial Sections of the Manchester District Institution—the Sections representing now works having in the aggregate an output of 20,000 million cubic feet of gas—have likewise proved, in the three years' trial, a very remarkable success, according to the testimony which has come from those who have participated in both the work and the benefits. Again in the northern part of the Eastern Counties, there has been (detached, however, from the district organization) similar united action on the part of a few gas managers; and there is a oneness of opinion among them as to the financial advantage. Through the information thus placed in his possession, Mr. J. Carter, for example, relates how on various occasions, he has been able to circumvent the finesse of buyers who (without the information he had at hand) would have succeeded in obtaining contracts from him at reduced prices. Mr. Carter, too, with his district experience, is inclined to think that this is a work that should develop into something of a universal character in the country, with its active centre in the Institution of Gas Engineers. That, however, is too big a subject for an immediate pronouncement; but it is one that could be usefully discussed by those with an intimate experience of what has been done to the present stage. If personal testimony as to the efficiency of the operations of these Commercial Sections, worked in connection with District Associations, be wanted by readers—and we cannot imagine readers not being sufficiently interested in their residual products as not to be desirous of learning of these things—Mr. Shadbolt's paper and the discussion that it evoked should be carefully perused. The success of experiment carried out in any given direction suggests the advisability of other organizations following suit, and taking the matter into consideration. Through them, and through them only, is the way to the consummation of the aspiration to which Mr. Carter has given voice. Meanwhile, we shall hear further of Mr. Shadbolt's paper, seeing that the matter has been referred to the Committee of the Association for report, and most conveniently the author himself will be the President in the coming year. He will, therefore, in all probability, make the question one of some prominence during his term of office.

Regarding Mr. Child's paper, and the methods which he prescribes for attaining economy in gasholder construction, the latter have the merit of having been put to successful test during the past four years at Romford. One of those methods, however—that referring to the construction of the tank bottom—will be regarded as a piece of daring that will not meet the approbation of many engineers; and imitation by those who would fain follow the example can alone depend upon the circumstance of the fitness of site. That Mr. Child has been successful may be an inducement to others to make trial; but the risk attaching to it, save in exceptionally favourable situations, would be too great a strain on the nerves of most engineers, for them to attempt to follow the lead of Mr. Child in this direction—circumspect though that gentleman is in his professional doings. The Gadd and Mason spiral-guided holder of 500,000 cubic feet capacity which he put into the tank is another matter; and his paper will revive interest in this system of holder construction. It says something for it that the longer users have experience of it, the louder are their praises of its perfection in working. But the chief factor in the more general adoption of this method of construction must be that of economy; and when Mr. J. T. Jolliffe tells us that for a million cubic feet holder for Ipswich the quotations were higher for a spiral-guided than for a column-guided one, it somewhat depreciates the very point of advantage that Mr. Child was seeking to make, but which advantage he did undoubtedly secure in his own case. One looks for an explanation as to this difference of experience; but failing to find it, rather sharpens than lessens curiosity.

The Waverley Association Meeting.

THE Waverley Association meeting at North Berwick last Thursday proved to be an unexpectedly large, and exceedingly quiet, gathering. In contrast to the meeting of the previous week in Glasgow, where electric lighting was not mentioned, this was the only subject which the President—Mr. J. Gemmell, of Melrose—introduced to the meeting; and it was practically the only one which was discussed. Probably the shortness of the time at the disposal of the meeting was the chief reason why the proceedings were of the single-barrel order, because it is open to anyone, at the Waverley meetings, to introduce whatever question may be of interest to him. The President's address consisted of a narrative of the methods he had adopted to retain his hold upon the community in face of competition from an Electric Lighting Company which is proportionately more than usually severe. This must be, to him, the most interesting topic at the present time; and that was sufficient to justify him in making it the groundwork of his address. That he was able to assure his hearers that he is continuing to hold his own, is, in the circumstances, matter of congratulation to him, as it cannot fail to be matter of encouragement to gas managers situated in small towns. It would seem, from what was said in the address and in the course of the discussion, that, under present conditions, there is little fear of electric lighting giving trouble to gas undertakings in small towns, unless they can secure the ear of the corporation, and get the street lighting into their hands. On this subject, the several remarks of Mr. A. C. Young, of Arbroath, and Mr. D. Vass, of Airdrie, are worthy of being noted, because they are, in effect, eye-openers as to the methods of promoters of electric lighting ventures, in their endeavours to obtain a footing. An innocent-looking condition in an agreement with a corporation may turn out to have consequences reaching further than is anticipated, and may, as was said, be found to be a great hardship. The explanation of the largeness of the meeting may be set down to the desire to see the new gas-works at North Berwick. These, as was to have been expected, have in every way fulfilled the expectations formed of them when they were opened last October.

The Budget.

THE Budget was a disappointment to many who had counted with great confidence upon a reduction of the income-tax. Some were, indeed, sanguine enough to expect that such reduction would be the substantial one of 3d.; and there were few believers in the prospect of a remission who did not look forward to the tax being brought down at least to 10d. Even this figure would be a high one for a time of peace, especially when compared with the rates prevailing a generation ago. Then, for a few years, the rate was only 2d., from which it is evident that the income-tax payers of the present day are bearing a very much larger share of the expenses of the State than any of their predecessors. The unexpected, however, has happened, and the claims in this regard of those who may be said to constitute the bulk of the supporters of the Government have been passed over. Instead, there is the partial remission of a tax which bears upon all classes in proportion to their consumption of the article affected—namely, tea. A reduction of 2d. per pound on tea is undoubtedly a popular measure; and it is something to be thankful for that it is found possible to please—if not to satisfy—both tea drinkers and tea planters.

In another direction, also, the Government have shown a degree of courage which is commendable. Possessed of a comparatively slender surplus, for which there were many claimants, they have declined to court popularity by satisfying one or other of these, but, instead, have set aside a large portion of the surplus for reduction of debt. No one will be disposed to object to this, since probably all are agreed that the national indebtedness—so largely increased during the Boer War—is not being reduced at too rapid a rate, and would thus gladly see a larger amount set aside annually for its reduction, if this could be done consistently with a due regard for relief from taxation as a means of stimulating trade. In this view, it may well be urged that perhaps a better use might have been made of this money had it been applied to the remission of the tax on exported coal. This tax, it will be remembered, was condemned by the Royal Commission on Coal Supplies, on the ground that it tended to limit the quantity of coal raised—this being undesirable, because, the greater the quantity that is raised, the lower is likely to be the average cost. It is obvious, too, that the amount of employment provided by the coal industry must be proportionate to the quantity raised; so that to limit this by any artificial means is a sure way to swell the ranks of the unemployed. There can be but little more justification for such a tax than there would be for a tax on oil or cotton exported from America, or on wheat from Canada, or on wool from Australia. Advocates of the tax point to the probable exhaustion of our coalfields as a reason for its continuance; but this, according to the latest information, is now more distant than ever, and there is every probability of the exhaustion of the oil wells in America taking precedence of it. This is a subject with which the gas industry is intimately concerned. It is more than ever necessary, in these days of competition, that coal should be bought in the cheapest market; and the tax bears hardly upon all foreign gas companies, whether of English origin or not, who feel the stress of competition just as keenly as do those who are nearer home. One particularly gratifying feature in the national revenue account is the diminished receipts resulting from what the Chancellor of the Exchequer described as a "wave of sobriety passing "over the country." There are certain signs which induce him to believe that this has come to stay, which is good news indeed, since hitherto such "waves" have indicated a comparative lack of the means wherewith to satisfy the national drink craving.

But however satisfactory in some of its features this Budget may be, the enormous expenditure which continues to be incurred is a matter of national concern. It is not possible to regard with equanimity an expenditure from 40 to 50 per cent. in excess of that which was found to be sufficient only a few years ago, and for which no adequate explanation seems to be forthcoming. It is the non-productiveness of the money thus withdrawn from circulation that presses heavily upon industry, and retards the return to more prosperous times. This it is the business of every taxpayer to seek to remedy, regardless of politics or party.

Nil Desperandum.

There is after all to be no appeal by the South Suburban Gas Company against the decision of Mr. Baggallay, at the Greenwich Police Court, in the matter of the summons for an excess of sulphur impurity, which the Company claimed was due to an "unavoidable cause." The Magistrate, it may be remembered, inflicted a fine of £10, and fixed the costs at 25 guineas. It has been felt by the Directors of the Company that, in view of the abolition of the sulphur clauses by the Company's Bill now in Parliament (which, by the way, is unopposed in the House of Lords), it would be a ridiculous waste of time and money to go forward with the appeal. They therefore informed the Lewisham Borough Council that, if they would forego the penalty of £10, the Company would pay the costs; and as this proposal has been accepted, there is an end of the matter. So closes the history of the struggle for freedom in this direction; and one cannot help extracting a moral from this long-drawn contest with stubborn misconception and prejudice. The struggle has been going on for a generation. In the seventies the Company promoted a Bill for the abolition of the sulphur clauses, and failed. In 1903, they tried again, and failed. In 1904, there was the third effort; and that was frustrated by the then sitting Departmental Committee. But in 1905, perseverance is rewarded by success. The moral is, "Never despair." We need not remark upon the part that Sir George Livesey has personally taken in this struggle; and among the *memorabilia* which can be attributed to him is this: "Never give up, when you have reason on your side, any object that is worth struggling for." These words are peculiarly appropriate at the present time. In the matter of the sulphur clauses, many considered the endeavour to effect their abolition a hopeless one; and, in fact, abandoned hope. The Company supply other illustrations. In 1903 they were opposed, as the South Metropolitan Gas Company had been before them, by the London County Council and other Authorities in their application for power to offer issues of stock in the first instance to consumers; last year they secured the power. They have also been obstructed by the Authorities in reducing the illuminating power of their gas, in order that a cheap supply of it may be given to the consumers

consistent with present-day needs. The Company have not yet succeeded—this year owing entirely to the abomination in the matter of testing. Next year, the Company will appeal to Parliament again to allow the 2 candles reduction, with a reasonable mode of testing the 13-candle gas. The cost of fighting to obtain for the gas consumers what will be a lasting benefit to them will exceed £10,000. This represents the terrible waste caused by the arrogance as well as the crass ignorance of their municipal "representatives." What a misnomer!

The Devonport Imbroglio.

The events of the past week have removed the controversy at Devonport beyond the range of useful newspaper comment or criticism. What was at the outset apparently nothing more than a difference of opinion on a matter of technical interest, has developed into a personal dispute which touches the honour and professional conduct of the Gas Engineer, and a threat of legal proceedings. Such charges as Alderman Hornbrook and Mr. Banbury have brought against Mr. S. E. Stevenson can only be answered in one way; and Mr. Stevenson was no doubt well advised in declining the invitation that he should address the Council in his own defence. Whoever is to decide between him and the Chairman of the Gas Committee, it is certain that a body which has given such manifestations of partisanship as the Town Council is not qualified for the task. In the excitement caused by the attack on Mr. Stevenson, the controversy respecting the different systems of water gas was practically lost sight of; and it is not likely that any further opposition will now be offered to the decision of the majority of the Gas Committee of the Council in favour of the installation of carburetted water-gas plant. A rude awakening may, however, await those who suppose that the adoption of water gas will enable the Corporation to postpone indefinitely the reconstruction of the retort-houses and other works recommended by the Engineers. The scheme for the reconstruction of the works contemplated the erection of a house with inclined retorts capable of making 1,500,000 cubic feet a day, as well as water-gas plant. In the three years which have passed since this recommendation was made, the existing retort-houses have not become any better adapted for the economical manufacture of gas. It is clearly not the fault of the Engineers that they have not been replaced by a more up-to-date structure. If their recommendations had been promptly acted upon, the new works might by now have been practically completed. The Committee have, however, been possessed with a spirit of suspicion and indecision, the result of which is what we see. With the Committee and the Engineers so hopelessly at loggerheads, progress has been impossible.

Education Authorities as Passive Resisters.

We have long been familiar with the "passive resister," who, from conscientious motives (and sometimes, it is to be feared, for the sake of notoriety), prefers to go to prison rather than pay that portion of his rates which is allocated to the purposes of education under the new Act; but now we hear of the school authorities themselves resisting—the payment of their meter-rent. One reader of the "JOURNAL" informs us that he finds himself confronted with this difficulty; and it is very likely that others are also. If anyone has experienced the trouble, and has successfully overcome it, will he kindly say, for the benefit of his less fortunate brothers, how he has done it? We do not, of course, anticipate the possibility of being able to mete out to the authorities the same treatment as is accorded to the other kind of resister; but we are hopeful that some less drastic suggestion may be forthcoming. Briefly, the case our correspondent puts before us is as follows: His County Council took over the education work under the new Act last September; and in paying the December quarter account for gas supplied to a non-provided school, they struck out the items for meter-rent. Upon it being pointed out to their representative that, under sections 13 and 18 of the Gas-Works Clauses Act, 1871, every consumer is required to consume gas by meter, and where such meter is the property of the gas company to pay for the hire of same, the charge being "recoverable in the same manner as the rents or sums due to the undertakers for gas," he pointed out that the balance was for rent of meters, "which the Board of Education have decided is the liability of the school managers." What our correspondent is anxious to know is whether any such decision of the Board of Education, if correct, has the effect of over-riding the Act referred to; and, if not, who would be the proper official to proceed against under clause 23 of the Act (without cutting off the gas), in the event of such a course being decided upon. He is also doubtful as to whether it would be better to return the cheque stating that it cannot be accepted in settlement of the account, or accept same "on account," pending proceedings being taken. We seem to remember a somewhat similar point cropping up some time ago; but a careful search through the somewhat bulky volumes of the "JOURNAL" has failed to locate it, so as to ascertain what the upshot was.

Poplar's Financial Troubles—Costly Public Lighting.

The Poplar Borough Council are as a house divided against itself; the cause of the division being of financial origin. The Council are in a muddle; and people are losing faith in them. In the circumstances, the common course is being taken within the circle of councillors of everybody blaming someone else, and no one owning up to any responsibility. The present overdraft of the Council at the bank amounts to £30,000; and the bankers lately flatly refused to grant a further overdraft until the sanction of the Local Government Board or the County Council had been obtained. The fat was then in the fire; and the Council resented the slight cast upon their dignity by such plebeians as bankers. But they had to bow to the bankers, and obtain the consent of the County Council before their coffers could be replenished by borrowed moneys. The latter Authority have taken the occasion as a suitable one for administering a little admonition on the subject of spending before obtaining consent, though the reproof and warning lose some of their weight coming from a body who have shown in money matters so atrocious a disregard of the interests of London ratepayers. When recrimination runs riot in a Council Chamber, then truth on matters which are at other times scrupulously kept from the ratepayers' eyes frequently shoots into the light. Poplar, as we have recently shown, now occupies an unenviable position in respect of its rates; and when the financial difficulties were being discussed the other day, the electricity undertaking came in for an amount of abuse as being an important factor in the present trouble. Some of the councillors cannot see where the prudence comes in of paying about £7000 more for public lighting by electricity than in the days of gas lighting, and yet only obtain from the electric lighting undertaking (as they did according to the accounts last published) a net profit of less than £3000. This is becoming a sore point almost everywhere; but a most ludicrous thing is that councillors are taking credit to their electric light undertakings for the reductions in the price of gas by the local supply companies which the prosperity of the gas business enables them to make—claiming, in effect, that the reduction in the price of gas is a material profit to the ratepayers derived by the operations of the municipal electricity undertaking. This comic position is taken by at least one of the councillors of Poplar, who blandly asserts that, "since the Council introduced electricity, they have secured a reduction in the price of gas, the gas has marvellously improved, and the inhabitants generally have benefited by their enterprise." The beauty of the argument will be better seen when it is considered in connection with the fact that the illuminating power of the gas has been reduced, under statutory authority, from 16 to 14 candles, and that this carried with it a reduction in price. From indications afforded by remarks at the Council meeting, it seems likely that the finances of the electricity undertaking for the past year are not coming out so satisfactorily as the councillors would like; but whether this is so or not, the members of the Electricity Committee are having a fairly lively time of it from their colleagues who look upon the undertaking as a channel of much wastefulness.

Workmen and the Law.

Last week the House of Lords were enabled to finally set at rest several important questions of interest to workmen and their employers. It is fortunate indeed that there is a point in litigation beyond which it is impossible to go, and that when this stage is reached (after the expenditure, be it remarked, of much time and money) one is able to say definitely, "This is the law of the land of the subject." This point is, of course, the House of

Lords, whose judgments present added interest to the reader—apart altogether from the effects on the litigants directly concerned—from the fact that they cannot be upset. So many actions involving important principles, and certain to have far-reaching results, are so obviously destined to be eventually settled by the House of Lords, that it seems almost a pity that they cannot be commenced as well as ended there. This, however, cannot be; and so it is necessary to begin at the beginning, and several trials have to be gone through, though each party may all the time be perfectly well aware that neither he nor his opponent will be satisfied to accept an adverse decision so long as there remains a higher tribunal to which it is possible to appeal. Two of the cases which have just been definitely settled are of a Trade Union character; and they arose out of disputes between coal miners and their employers. These we will briefly notice in a moment. Then there were three actions in which their Lordships, not by any means for the first time, were asked to determine the scope of the Workmen's Compensation Act. In one of these it was decided that compensation could be recovered in respect of a man who died of anthrax contracted in the course of his work, though Lord Macnaghten took care to point out that it must not be taken that the Act covered any case of infectious disease. The other two actions arose out of accidents which took place on vessels while lying afloat in a dock; and the judgment was against the men. This reversed decisions by the Court of Appeal, but upheld the conclusions originally arrived at by the County Court Judges. Thus it seems that a ship does not, by being moored in a dock, become, with the dock structure, a "factory" within the meaning of the Act. This, however, must not be confused with a previous case, in which their Lordships held that compensation was payable where the shipowner hired a dock and placed the vessel in a dry berth for repair. Altogether the Workmen's Compensation Act must have been as great a friend to the lawyers as the man is proverbially said to be who undertakes to draw up his own will.

The Miners' Stop Day.

Of the miners' actions the one possessing the most widespread interest was that brought by the Glamorganshire Coal Company against the South Wales Miners' Federation to recover damages on account of their having induced men employed at the collieries to break their contracts of service. In 1900 and 1901, various "stop days" were ordered by the Federation, in spite of the protest of the employers, and a warning that if work was stopped legal remedy would be sought. At the time of the first stoppage the celebrated Taff Vale case had not been finally settled, and the Federation doubtless thought themselves free to do just as they liked. But with the recognition of the fact that Trade Unions were amenable to the ordinary law, the officials realized the seriousness of their position, and an attempt was made to shift the responsibility off the shoulders of the Federation. It, however, failed, as it deserved to do; and the result is this new "blow to Trade Unionism," and the vindication of a master's right to insist upon the due fulfilment of an agreement. It may at once be admitted that the Federation's conduct was far less reprehensible than that of Labour Leaders who order bodies of men out on strike. The stops—a day here and a day there—were fixed upon as a device for checking the production, and so keeping up the price, of coal, in which the men had a direct interest as they were working on the sliding-scale. Further than this, however, it is impossible to support them. They deliberately, after ample warning of what the consequences would be, persuaded the men to break their monthly contracts with the employers, instead of going to the latter, as they might well have done, and endeavouring to come to an agreement to restrict the output if such a course was advisable in the interests of trade. In the result, the Colliery Company suffered very material damage; and this the Federation will have to make good. The decision is one which nobody but themselves will be likely to quarrel with. It is clearly good sense, and the fact that the House of Lords were unanimous in their opinion makes one feel equally confident that it is good law. After more than three years' litigation, the South Wales Miners' Federation will doubtless now understand that the sanction of two parties which is necessary to the making of an agreement is, in the eye of the law, equally necessary to the setting of it aside.

A Misapplication of Funds.

Now we come to the last of the cases lately decided, which has also been disastrous to the Union concerned. The events which led up to this action are ancient history, they having taken place as far back as the early part of 1902. At that time a dispute arose between the Denaby and Cadeby Collieries Company and their miners, the outcome of which was, as the masters termed it, a strike, or, as the men professed to regard it, a lock-out. The matter was noticed in the "JOURNAL" at the time of its first coming before the Courts. The action was brought against the Yorkshire Miners' Association by one of the members of that body to restrain the distribution of strike pay to the Denaby men who were on strike under circumstances which did not entitle them, according to the rules of the Association, to such benefit. The facts did not appear to be greatly in dispute; and their Lordships confined their attention to deciding whether the action could be maintained by the member who brought it, or whether it was one that was prohibited under the Trade Union Act of 1871, which provides "that nothing in the Act shall enable any Court to entertain any legal proceedings with the object of directly enforcing or recovering damages for the breach of" certain stated agreements for the application of the funds. This provision, the Lord Chancellor took it, meant that the Courts should not interfere with the distribution of funds according to the rules of the Union concerned, but not that there should be no recourse to law where it was threatened to divert them. It has long been a complaint with regard to Trade Unions that members could not force these organizations to do what they undertook to do—that is, that they could not "directly enforce" agreements for the application of the funds. But at any rate now they will not have to sit by and watch the spending of their meney (or its misapplication) in contravention of the rules. The point is a little involved, as is shown by the fact that four of the noble Lords affirmed the decision of the Court of Appeal that the action was maintainable, while two held that the Association were entitled to succeed in their appeal. No wonder the Labour Leaders are so anxious to get the law relating to Trade Unions altered. Why, not only is it possible for employers now to hold these august bodies responsible for the actions of their officials, but even the members who find the money can, under some circumstances at least, prevent it from being paid away in a manner that is against the rules. How can the Trade Unions be expected to conduct their business satisfactorily (to themselves), if they are to be reduced to enjoying merely the same "rights" as other people do?

An Assessment Anomaly.

Preparations are being made for the quinquennial assessments; and there is the likelihood of some big fights ensuing, as the result both of municipal trading and the necessity, through maladministration, of the Local Authorities squeezing as much as possible out of the already much overburdened ratepayer. There is an irregularity associated with the rating of property in London, which permits of serious injustice being done to both the general ratepayers and to such private enterprise as comes into competition in any form with the County or Borough Councils. The latter are now the Overseers of the parishes within their boroughs; and it is not consonant with common sense nor the customary manner of adjudicating upon secular affairs that a Committee composed of members of such a Council should be allowed to determine their own assessments or objections against them. It is contrary to human nature that a man should always be the best and most unprejudiced judge of his own actions, or the arbiter of fair apportionment where his own interests and those of other people are in question. But here (as pointed out by Mr. Harold Griffin, in a paper before the Battersea Municipal Alliance) these Councils sit, as it were, in judgment upon themselves, as well as other people; and under such a condition of things, what is likely to be the result? They hold much rateable property as actual occupiers, and are addicted to all the vices of municipal trading and reckless borrowing; and therefore it must be difficult, if not impossible, for them to actually fulfil the part of the upright and impartial judge. Mr. Griffin in his interesting paper enumerates the classes of their own property that the Councils are left to assess—such as town halls, schools, libraries, baths, stables, electric lighting stations, wharves, tramways, artizans' dwellings, municipal lodging-houses, and

municipal milk shops. Any deficiencies in the assessments of these properties must fall upon the general body of ratepayers; while, in the majority of those properties, those who patronize should contribute to all fair charges upon them. There is no question that such property should be assessed by an independent authority; for otherwise there will always be a temptation to ease the municipal property of charges in this respect, and wrest as much as possible from competing interests. It is submitted by Mr. Griffin that the local Bench of Justices would be a more suitable body to act as an Assessment Committee. That again depends on their intimacy with the management of local affairs.

The Sittings and Work of Parliament.

At the end of May, 1903, some alteration in the period of the sittings of our Legislative Houses was foreshadowed. As comment on the subject in the "JOURNAL" for June 2 of that year showed, Lord Newton had moved the House of Lords into a state of agreement with him that it would be to the advantage of public work —to say nothing of the benefits to our legislators—if Parliament would meet about the middle of November, have a vacation of from five to six weeks at Christmas, resume again in February, and prorogue in July. About the same time, Mr. Balfour also indicated that some rearrangement might very possibly be made in order to facilitate the transaction of public business. But what the Lords at the time apparently regarded as a brilliant idea, and of which they were proud, inasmuch as it had germinated entirely in their midst, has not so far developed into anything more; and now, nearly two years later, Lord Newton has asked the House to declare the desirability of appointing a Joint Committee to consider the advisability of carrying into effect his former resolution. But, strange to say, the lustre of the original idea has sadly faded; for all his Lordship's humour and ingenuity could only obtain for his proposal the adherence of seven of his peers, while 68 declined their attachment. Even the opinions of the Upper House are subject to mutation. Akin to the same matter is a protest that the Lords have sent down to the Commons regarding the practice of introducing Bills into the Upper House under conditions which afford insufficient time for their consideration; and what is more their Lordships have declared their mutinous intention of declining to consider any Bill unless sufficient opportunity is afforded for due deliberation upon it. Well said; but occasionally it is the House of Lords who do not allow the Commons adequate time for the consideration of measures of public importance—as witness the Electricity Supply Bill last year.

In the report of the remarks made by Mr. W. Wilson at the Informal Meeting of Scottish Gas Managers in the last number of the "JOURNAL" it should have been stated, with reference to the use of lime, that he "saved 30 cwt. per week in the winter time by getting *self-sealing mouthpieces and* an exhauster." The words in italics were inadvertently omitted.

In the particulars sent to us in regard to Mr. Wentworth's appointment at Aldershot, and given in the "JOURNAL" last week, it was stated that he was the Chief Assistant to the Portsea Island Gas Company. We learn that Mr. Wentworth was engaged by the Directors of the Company as Works Superintendent at their Flathouse station. This explanation is necessary as the Company have other stations at which Mr. Ashworth, the Engineer and General Manager, has Assistants holding equal positions.

Mr. J. C. Cottam, who was at one time prominent as a company promoter—among his many schemes being the Water-Gas Corporation and the Frank Wright Gas-Meter Company—died last Wednesday week at Leigh-on-Sea, Essex. Referring to the various schemes for which deceased promoted companies, a writer in the "Financial News" last Friday said: "Mr. Cottam's name will perhaps chiefly be remembered in connection with the heavy water-gas companies which he fathered. As usual, the one idea gave birth to a group of ventures, and British Water Gas was followed by Nottingham and Derby Water Gas and North British Water Gas. Everyone will remember the long and unhappy squabbles to which the water-gas schemes gave rise, and the premature ending of the whole enterprise. The complete success of the patents in America shows that it was the management, and not the idea, which was at fault. Mr. Cottam himself had great faith in water gas, and paid dearly for his confidence. One way and another, it has been computed, he dropped £100,000 in the business from first to last. Considering all the harsh things that were said of him in this matter, it is only fair to record that he purchased shares with his own money in the market when they stood at £18."

INSTITUTION OF GAS ENGINEERS.

The Proceedings at the Annual Meeting.

THE arrangements for the forthcoming meeting of the Institution—to be held in the Lecture Theatre of the Institution of Mechanical Engineers, Storey's Gate, commencing on Tuesday, the 30th prox.—are now being rapidly completed.

After the usual opening proceedings, the President, Mr. Daniel Irving, of Bristol, will deliver his Inaugural Address, and the programme of papers arranged for reading and discussion has already assumed a satisfactory character. It includes one dealing with "Pyrometers and Carbonization," by Mr. John Bond, of Southport; while Mr. J. H. Brown, of Nottingham, will write on "Experiments with Low-Grade Mixed Gases." A paper on the "Testing of Gas in the Metropolis, arising out of the Board of Trade Departmental Committee's Report," is to be presented by Mr. Charles Carpenter. "The Manufacturing Costs at Granton" is the title of a paper to be read by Mr. W. R. Herring, of Edinburgh; Mr. E. C. Riley, of Swindon, is preparing one on "Incandescent Gas Lighting for Railway Trains and Rail Motors;" the subject of a paper by Mr. Alexander Wilson, of Glasgow, will be "Outside Producers;" and yet another paper will be on "Structional Engineering," by Mr. A. Doig Gibb, of Newcastle-on-Tyne.

The lecture this year is to be delivered by Professor Arthur Smithells, B.Sc., F.R.S., Professor of Chemistry in the University of Leeds; his subject being "The Temperature of Flames."

A reception and dance will be given on the Wednesday evening by Mr. and Mrs. Irving, at the Royal Institution of Painters in Water Colours, Piccadilly; and it may be added that for the Friday a visit is being arranged to Hastings, with an inspection of the new works of the Hastings and St. Leonards Gas Company, at Glyne Gap, near Bexhill—an illustrated description of which appeared in the pages of the "JOURNAL" during May and June of 1903 and 1904.

The President and the Directors of the Bristol Gas Company.

There was a meeting of the Council of the Institution at Bristol last Friday, and Mr. Irving took the opportunity afforded by so many of his colleagues being present in the city to invite the Chairman and Directors of the Gas Company and a few prominent townspeople to a luncheon at the Royal Hotel, College Green. Among those who assembled to meet the Council were Alderman J. W. S. Dix, the Chairman of the Gas Company, and two of the Directors, Rev. P. R. Sleeman and Mr. J. H. Howell, J.P.; also Mr. John Phillips, the Secretary. The townspeople who accepted Mr. Irving's invitation included Mr. T. H. Yabbicom, M.Inst.C.E., the City Engineer, Mr. T. Morgans, M.Inst.C.E., Mr. J. A. M'Pherson, Assoc.M.Inst.C.E., the Engineer of the Bristol Water-Works Company, Mr. H. Farraday Procter, the City Electrical Engineer, Mr. G. T. C. Edwards, the Engineer of the Tramway Company, and Mr. N. Watts, Assoc.M.Inst.C.E., the Hon. Secretary of the Association of Bristol Engineers.

The Design of the "London Medal."

At the Council meeting, Mr. H. E. Jones submitted the design he had had prepared for the "London Medal," which he announced at last year's meeting of the Institution he was prepared to offer to take the place of the grants of money formerly given to the readers of the three best papers at the annual meetings during the next five years.

THE NOTTINGHAM GAS-MIXING EXPERIMENTS.

Visit of the Committee of the Midland Association of Gas Managers to the Basford Gas-Works.

It appears that Mr. J. H. Brown, the Gas Engineer of the Nottingham Corporation, has continued there the interesting experiments which he commenced at the Ilford Gas-Works upon the use of blue water gas in conjunction with the carbonization of gas coals. After having conducted a remarkably unique series of experiments on the question of self-enrichment and into the use of the so-called Lewes process with various coals and cannels, and having obtained what he believes to be correct and reliable results, Mr. Brown communicated with Mr. Charles Meiklejohn, the Secretary of the Midland Association, asking if the Committee would visit Nottingham to examine the experimental plant at the Basford Gas-Works, where the trials have been made and the results obtained; and, if possible, to ascertain whether there were any circumstances or conditions likely to interfere with the accuracy and reliability of the results. He also requested that they would freely criticize all the methods, processes, figures, and facts which were submitted to them. For while he stated that he has no brief for blue water gas and its use in conjunction with coal gas, yet he is anxious to arrive at the absolute truth of the matter. No doubt readers of the "JOURNAL" will remember the remarks which Mr. Brown made on the process at the meeting of the Midland Association at Birmingham in February. The figures submitted are in many respects most striking; and it was on this account that he desired to have the benefit of the criticisms of the Committee of the Association.

The plant is of full working size; and an ordinary bed of retorts in No. 1 retort-house at Basford has been used. With coal gas alone, a make of above 12,000 cubic feet of 16-candle power gas per ton of coal was recorded for several days in succession. Afterwards water gas was admitted into the retorts and into the hydraulic mains, with the result that, although the make per ton of coal gas alone remained the same in many cases, the gain in pounds of sperm per ton considerably increased. Mr. Brown stated that the belief of many was that the increased make of gas per ton of coal was due to furnace gases being drawn in through the pores of the retorts. In order to meet this contention, the percentage of oxygen and carbon dioxide was estimated in the crude gases after making allowance for the percentage of these products existing in the crude water gas which was added to the coal gas; and the water gas and the finished gases were carefully measured in proper station meters corrected for N.T.P. A complete analysis of the water gas, the crude mixed gases, and of the finished gases were also carefully taken at least once every 24 hours. The effect of the self-enrichment on the naphthalene, the cyanogen, the tar, and the ammonia was also carefully investigated; and the general impression of the members of the Committee was that all possible precautions had been taken to avoid the creeping in of any possible error. Samples of the tar have been taken daily; and at the conclusion of the present experiments, they will be carefully distilled. The experiments are being carried out by three and sometimes four capable chemists, working in shifts throughout the twenty-four hours.

Not only were the results of the experiments submitted to the Committee, but the actual figures, and the workings out for each result, which have been scrupulously retained in a book day by day. The experiments have extended over a period of nearly two years; and consequently a tremendous mass of figures has been accumulated. The most striking of the results recorded by Mr. Brown is the large make of coal gas per ton, amounting on one day to the abnormal quantity of 14,300 cubic feet; while, although this make per ton fluctuated between extreme limits, yet the sperm pounds per ton for each series of tests remained very constant. A careful record of the total cubic feet of hydrocarbons per ton has also been estimated, as an indication of the efficiency of the self-enrichment process. This was found to remain fairly constant for each series, and showed a considerable increase due to the process. It may be well to point out here that Mr. Brown has at times obtained some really remarkable figures; but though he has carefully retained, and will publish the results for these abnormal days, he places no reliance whatever on any figures which he found that he was unable to repeat at will. The sulphate of ammonia also was very erratic, although he assured the Committee that the estimations were perfectly accurate and reliable.

In Mr. Brown's opinion, the most remarkable point in all his investigations with this process is the abnormal increase in the quantity of tar per ton of coal. Although he has been obtaining in some cases a large increase in the number of cubic feet of gas per ton, and also of illuminating power, at the same time he has secured an increase of 50 per cent. in the number of gallons of tar per ton of coal; and this tar contains, contrary to expectation, a large increase in the oils distilling over at temperatures under 360°C. On several days in succession, a yield of above 30 gallons of tar was obtained, together with a make of between 11,000 and 12,000 cubic feet of gas per ton of coal.

The experiments have been carried out with various coals and cannels; and the Committee of the Midland Association on their visit were informed by Mr. Brown that he is at the present time experimenting with the same description of coal as that used by Professor Lewes at Sydenham in 1900-1901.

Altogether the results are extremely interesting, and tend to show that really there is yet much more to learn about carbonizing—the principal process in the manufacture of gas. The members of the Institution of Gas Engineers will no doubt look forward with considerable pleasure to hearing and discussing the paper that Mr. Brown proposes to bring before them at the forthcoming meeting.

A PEEP INTO THE "QUESTION-BOX."

SECOND ARTICLE.

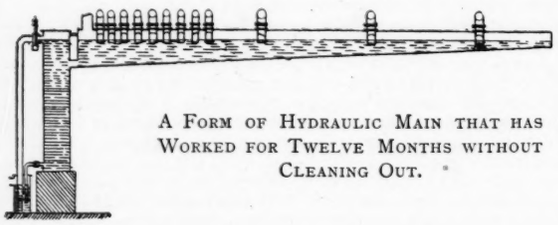
To the third section of the "Question-Box" of the Ohio Gaslight Association, we have the heading "Manufacturing Operation;" and anyone musing over those two words in their application to gas making, will see the multitude of simple and complex inquiries which they may be made to cover. As a matter of fact, they do in this volume introduce us to questions numbering nearly 100, and of great variety; and the printing of the replies to them claims something like 130 pages. The indiscriminate mixing of the subject-matter is the point at which one would be disposed to level criticism; the amount of interesting and useful matter is, however, a counterbalancing merit. But why should not discrimination displace the medley which is before us, by the simple process of the sub-division of the subjects under the main head? This would bring together all the questions and answers referring to water gas, all those dealing with producer gas, retort-bench operation, and so on, without having them sprinkled about without any attempt at orderly arrangement.

An early question in which one gets interested is as to whether it is good practice to mix coal gas with water gas in a water-gas relief holder; and the weight of the replies is distinctly against such a practice. There are, however, others showing a contrary opinion; and both give their reasons for and against, so that the seeker after guidance is still left to mark out the direction of his own path. This want of unity of opinion on the point presents something for determination. The first answer printed emanates from a gentleman who is of opinion that mixing at the relief holder "seems" to offer the greatest advantages. He states that his observation of experiments made in mixing the two gases at various points in the works, convinces him that best results are obtained by first condensing and scrubbing the coal gas, reducing the temperature to about 70°, and, if possible, for the purpose of checking results, metering it, then passing it into the water-gas relief holder, the mixture to be again passed through condensing apparatus and purified together. This method would, of course, require the installation of a double set of condensing apparatus; but the advantages gained, it is believed by this correspondent, would compensate for the extra expense. The advantages are uniformity of candle power, as the mixture is under perfect control of the operator; increase in candle power, as the coal gas absorbs illuminants from the water gas that would otherwise be deposited; and also this method of mixing appears to have "a great effect in preventing naphthalene troubles." Typical of the reasons for the contrary view may be taken the answer of a correspondent that putting coal gas into the relief holder would make it necessary to pass through two exhausters, and also some special water-gas apparatus—such as "shaving" scrubbers—which would do coal gas no good. The capacity of the special water-gas apparatus would also have to be greater than if used for water gas alone.

There are comparatively few editorial or printers' slips in this volume, considering the haste with which it finally went through the printers' hands. We get pulled up, however, when in one of the responses to the question to which attention has just been directed, we read: "Yes, as their own weight would cause them to sag, if all the gas were removed or allowed to escape; and there were no supports to hold up the crown." Wonderingly, we pass on; and find the explanation when later the question is read: "In case an exhauster should draw off all the gas in a holder, would the vacuum produced be sufficient to draw in the crown plates on a holder?" There can be little doubt that some mischief would ensue; but the nature and extent of that mischief would depend very much on the circumstances and character of the construction of the holder. This generally is the view supported by at least seven pages of printed matter representing the answers given by several gentlemen. A succeeding question is in effect as to how often it is necessary to clean out the hydraulic mains to a bench of six beds of six horizontal retorts. We will not try to even briefly state the conclusions at which the correspondents have variously arrived over this weighty problem; but we may give a sketch (p. 154) of a hydraulic main one of them states has been at work twelve months without requiring cleaning. It is self-explanatory. Producer gas is a topic that has been fruitful of inquiry; and the distribution of the heat in retort-settings also serves as subject-matter. An inquiry as to the temperatures of gas at various parts of the gas-works plant produced a mass of opinion and experience, which is fairly well embraced by one answer, which states that, generally speaking, coal gas at the exhauster should range from 110° to 130° Fahr.; at the tar-extractor (if of the mechanical impact type), from 100° to 120°; at the final water-condenser, 60° to 80°; at the scrubber, 60° to 70°; and at the purifier, 60° to 70° Fahr. The remaining answers do not recede very

greatly from these figures. There seems to be, from the frequent references and recommendations one comes across, a great liking for the Pelouze and Audouin tar-extractor in America. It is mentioned in connection with the last question; and it is again met with in the correspondence evoked by an anxious inquirer for a "speedy remedy" for naphthalene. Gasolene, hot water, steam, washing with oil, oil-vapour, a reduction of the heats, slow condensation, and most of the well-known ancient and modern remedies are specified; so that it is still a question in America of taking one's choice, and trusting to good fortune.

Later on, the inquiry is put forward: "To what extent is lime purification for carbonic acid used in America; foul lime for bisulphide of carbon?" There can be little interest in the subject of lime purification in America, seeing that there are only two answers—one from Montreal and one from England. The one from Montreal is interesting. It states that in that city about 800 million cubic feet of coal gas are made annually; and lime is used exclusively for eliminating carbonic acid and bisulphide of carbon from the gas. These impurities are present in the gas; the former to the extent of 2½ per cent. by volume, and the latter from 80 to 100 grains per 100 cubic feet—the coal containing about 3½ to 4 per cent. of its weight of sulphur. By the use of about 4·95 lbs. of lime per 1000 cubic feet of gas made, the whole of the carbonic acid is eliminated; by the use of a further 1·13 lbs. of lime, the bisulphide of carbon is reduced to below 35 grains per 100 cubic feet—the Government standard. Lime, it is mentioned, costs 27 c. per 100 lbs.



A Form of Hydraulic Main that has Worked for Twelve Months without Cleaning Out.

Besides the two obvious expedients of frequent steaming and more gradual cooling by the use of extra condensers, is there (someone is curious to know) any way to prevent the accumulation of quantities of ammonium carbonate in the water condensers of a coal-gas condensing system. The condition is no doubt owing to the condenser being too small or faulty in construction and design, replies one correspondent, who also adds that cold water should be admitted at the exit of the gas, and warm water taken off at the inlet. The best remedy is an atmospheric condenser, or a long foul main, so as to gradually reduce the temperature of the gas before it meets the water condenser. Another correspondent points out that ammonium carbonate will not be deposited in the condensers of a coal-gas system unless the vapours by which they are carried are supersaturated. This condition may result from the use of anti-dips in the hydraulic main or its equivalent—the carrying of too low a water-level. A remedy for this trouble is to cause the gas to carry so much vapour that the point of saturation will not be reached until the carbonates have been removed from the apparatus. The advice of a third correspondent is that the accumulation of quantities of ammonium carbonate in the water condensers of a coal-gas plant may be reduced by the installation of a washer (using ammoniacal liquor) placed before the condenser; the reduction being effected by the removal of a portion of the carbonic acid, owing to the affinity existing between the alkali ammonia and the carbonic acid.

An interesting contribution is made by Mr. Alexander Allan regarding the interrogation, Are there any reliable figures relating to the effects on illuminating gas of bubbling through various oils or passing through oil-coated pipe? Mr. Allan writes: Tests made to show the effects of bubbling gas through the tar from a carburetted water-gas plant gave the following average figures—Illuminating power of the gas, 15·87 candles. Illuminating power of same gas, after bubbling through the tar at a temperature of: 50° Fahr., 13·65 candles; 55°, 13·90; 60°, 14·47; 65°, 15·35; 70°, 15·84; 75°, 16·52; 80°, 17·16; 85°, 17·84 candles. Specific gravity of the tar, 1·06. Light oils contained before experiment, 7·2 per cent. Light oils contained after experiment, 3·1 per cent. The gas-inlet tube dipped ¾ inch into the tar. The tests were made on a Letheby 60-inch bar photometer. Burner used, 24-hole "London" argand, with 6 in. by 1¾ in. chimney.

With some concern, one finds there is a very common opinion among gas engineers in the States (if the replies to a question on the subject are representative) that electricity is the cheapest and most convenient method of transmitting power round a gas-works. If round gas-works, then surely, too, round many works of a different character. Of course, different conditions demand different equipment, and those who favour electricity apply words qualifying their approbation. One response even advocates the keeping in reserve of some other form of power on account of the unreliability of electricity. The production of electricity by gas power is suggested; and steam and gas have their adherents. But little is said regarding compressed air. There is a mass of correspondence on the inquiry, Does a heavy seal in the hydraulic main really increase the deposition of retort carbon? There is a consensus of affirmative opinion. Little attention, looking at the poverty of reply, is paid in America to the question of utilizing blue water gas by running it through coal-gas retorts on what is known as the "Lewes" system; and it is thought there that it does not contain any commercial promise. It is equally clear, too, from a subsequent question and the answers thereto, that in America the gas profession has not yet arrived at the point of view from which they can see any great advantage in reducing the illuminating power of their gas. But they do not appear to have focussed upon the matter such serious deliberation as is necessary for the formation of a proper conclusion; but there are, of course, differences in circumstances between America and this country. A little later on, it is found that no replies were received to the inquiry, "Has the question of a standard candle power ever been discussed at any gas meeting, and with what results?" This is eloquent of a lack of interest in the general subject. A great deal more is found in succeeding questions as to naphthalene; but not anything that may be regarded as advancing general knowledge. It tells, however, of the subject of inquiry being just as troublesome in America as in this country. It is remarked, too, as showing a similarity of experience with this country, that "the present status of acetylene is about what it was several years ago."

This section of the book may be left with the remark that there is much more in it to engage the reader's interest than the first two sections.

THE GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 185.)

The Stock Exchange did fairly well on the whole last week; for in spite of some flatness at the opening, which was not at once dispelled, it brightened up later on, and closed with its tone in a more cheerful key. On the other hand, business was not brisk. The settlement before the holiday interval demanded serious attention, to the restriction of fresh business; but the process apparently has not been productive of any difficulties. However, as soon as that was assured, there was a general quieting down in preparation for Easter; and the next account looks like being a light affair. In the Money Market, there was a good supply to meet all demands; and when these were relaxed, a condition of marked ease ruled. Discount rates, too, from being firm became easier towards the close. Business in the Gas Market was much reduced in volume from anything comparable to recent averages; some days almost vieing with the quiet periods of last year. And this seemed to have its effect not only in checking rises in quotation, but in bringing one or two down from the points to which they had attained. But though the stream ran thus in the market, there was ample demonstration outside that gas securities are still on a rising tide with the public, for several fresh issues offered elsewhere were seized with alacrity. In Gaslight and Coke, the ordinary had a slight fall and a quick recovery. Dealings were not numerous; and the figures ranged from 97½ to 98½. In the secured issues, the maximum was done "specially" at 92; the preference (which was weaker) at from 111 to 113½; and the debenture at 90¼. South Metropolitan was fairly busy, but with a shrinking tendency; and stock changing hands at from 128½ to 127. The debenture marked 90. Commercials were similarly affected, but business was very quiet; the 4 per cent. being done at 116 and 116½, and the 3½ per cent. once at 113. The Suburban and Provincial group were very little touched. British changed hands at 40⅝, South Suburban at 120½, and West Ham preference at 124¼ and 124½. Lea Bridge was marked at 121, and Tottenham "B" at 100. The Continental Companies were as quiet as the rest. Imperial had a few dealings at prices varying from 219½ to 220½, ditto debenture at 98, Union was done twice at 110, and European found no sellers. Malta had a transaction at 4½, and Tuscan had one at 10. Among the undertakings in the more remote world, Bombay marked 6⅛, and Melbourne 4½ per cent. bonds at 102. Monte Video was done at from 11⅞ to 12¼. In Buenos Ayres, the shares marked 12⅜, and the debentures 97 and 97½. River Plate was done at from 13 to 13⅜. Primitiva ordinary changed hands at from 6⅛ to 6¼; ditto preference at from 5 1/16 to 5 3/16; and the debenture at 97.

The closing prices are shown in our Stock and Share List on page 185.

Gas Consumers and Employees as Stockholders.

We are pleased to record a further indication of the confidence of gas consumers and employees in the value of the stock of their companies. We learn that the recent issue of consolidated ordinary stock by the Enfield Gas Company, which was offered solely to consumers, stockholders, and employees, was applied for nearly five times over. This is a practical tribute of appreciation of the policy which gives the consumers a preference over the outsider in the issue of capital, and so helps to bring about more and more the distribution of profits in the locality in which they are earned. It is also evidence of the high estimation in which the concern is held as a good investment property.

ELECTRIC LIGHTING MEMORANDA.

London Electricity Bills—Charges and Other Matters—Newspaper Puffs—The Deception of the Public.

THERE is a little respite from consideration of the electricity power schemes that have created so much consternation among the existing electrical suppliers in London. The illness of one of the members of the Lords Committee who are considering the measures (Lord Romilly) and the rising of the House for the Easter recess combined to produce an adjournment until the second week in May, when the East London and Lower Thames Electric Power Bill will be taken in hand. The heaviest Bill of the nine, and the one against which there were most opponents—that of the Administrative County of London Company now only awaits the decision of the Committee; the last word that was to be said for it having been uttered by Mr. Fitzgerald, K.C., in replying for the promoters, on Monday of last week. Directly after, the Committee threw off the yoke for the period already mentioned. There were several matters of public interest in the closing speech of Counsel. The Company are taking advantage of a precedent that it has been before suggested in the "JOURNAL" might well be annexed, when opportunity favours, by gas suppliers who have electricity consumers using gas merely as a stand-by. The purveyors of electricity regard it as a grievance that factories and other large establishments generating their own electricity should be in a position to make use of the district electricity supply merely as an assurance against an interruption of their business and operations by reason of a breakdown of their own private service; and it has been conceded by Parliament in previous Electricity Bills that such a convenience is worth some monetary consideration. This being the case, the promoters of the Administrative County of London Bill are asking to be allowed to make a minimum charge for stand-by supplies of this kind. Allied to this subject is the wonderful fertility in the electrical world in the invention of methods for charging for current. In this Bill, there is a scheme of maximum prices; and it appears, to illustrate what is possible, that a consumer using electricity for one or two hours per day would be entitled to have it at 1½d. per unit. The consumer, too, will have the opportunity of paying £1 a quarter per kilowatt of the maximum power required to be supplied, and, in addition, ½d. per unit—that is to say, a consumer using one kilowatt for eight hours per day would for 624 units per quarter pay £1, and for each unit ½d. (£1 6s.), making a total charge of £2 6s., or under 0·9d. per unit. Of course, these prices refer exclusively to power supply. A point, about which controversy has been very keen during the proceedings, has been the omission from the Bill of power to purchase the undertaking by the local authorities, in accordance with the provisions of the Electric Lighting Acts. But the promoters are relying on the recommendation of Lord Cross's Committee, that, where sufficient public advantage is shown, power of supply might be given over the areas of several local authorities—this, of course, involving plant of exceptional dimensions and high voltage—upon conditions differing from those found in existing Acts. But the fact that Lord Cross's Committee made this recommendation does not stamp it with incontestable justice. An electric supply company is under the liability of purchase at the end of certain periods; this new Company, under no such liability, comes in, competes with the existing Company for the custom of large consumers, and depreciates its property. There is certainly an injustice here to both the Company and the prospective purchasing local authority. Local authorities, again, with electricity undertakings, are told that the new Company are going to offer them inestimable advantages; but the new Company touch lightly on the disadvantages to the existing authorities of the competition for the custom of their largest consumers, who make up their day-load. "Oh, for the blessing of a day-load!" was once the prayer of the electricity supplier. And now that it has been obtained, to have it taken away! Perish the thought!

The big drum has been noisily beaten over this Administrative County of London Bill, with the idea of raising popular enthusiasm, to ease the passing of the measure. Puff newspaper articles have been published—frivolous, misleading, and specious, and fact has been ruthlessly sacrificed to the imagination of the yellow-press type of scribe. Even the "Engineering Supplement" to "The Times"—about which supplement big things were prophesied, to which the highest engineering talent in the land was to subscribe, but the result of which, so far and for the most part, has been of a mediocre order—has opened its columns to accounts of the marvellous things that are to be accomplished when London is given over to these big concentration electricity schemes. About these articles there is not much to complain of. They have been of a temperate order, excepting in one or two minor respects, though, of course, they end up in leading the uninitiated reader to suppose that these companies bring within sight a land (metaphorically speaking) flowing with milk and honey. Colonel H. C. L. Holden is a writer on the subject; and there is little to quarrel about in his statements other than some general remarks in which he asserts that the more extended use of electricity for many purposes (which he duly specifies, and for which it is now only employed to a very small extent) is "entirely a question of cost," and, we add, of efficiency. He condescends to admit the formidable character of the rivalry of gas. But he says that electricity is "immeasurably superior" as far as lighting is concerned, owing to its cleanliness, healthfulness, safety, convenience, range of candle power, and quality of light. The Colonel must be a jocund sort of fellow to postulate thus freely in the columns of "The Times," when in other quarters at least five out of the six assertions have been disproved. Again, for power purposes, it is "also superior in safety, convenience, and flexibility" (which qualities as being superior are denied by us), but nothing is said by him about economy. More humorous still is the superiority claimed for electricity as a heating agent.

As, however, the Colonel avows it is entirely a question of price, and then goes on to claim that all that is now needed is the great concentration of electricity plant proposed for London to realize the highest blessings that humanity can hope for on this orb of ours, it would be as well if the daily papers which have held this Administrative County of London scheme up to the admiration and worship of the public would point out to their readers that the idea into which they have been led, that electricity is to be had by them in the future at a fraction below 1d. per unit is a delusion and a snare. That price is not for the general public; it is only for large buyers for power purposes, and for supply in bulk. So far as the general public are concerned, that is the wholesale and not the retail price. The Administrative Company will not get any authority from Parliament to supply for ordinary purposes, other than power supply, in competition with existing suppliers of electricity; and supposing they supply the present purveyors of electricity in bulk at below 1d. per unit, upon that figure has to come capital charges, and distribution and management expenses, as well as a profit, so that really the general public would not be much, if any, better off than they are at present. The existing suppliers, supported by responsible and influential men, aver that the public would not benefit in the least in the matter of cheapness by the passing of the Bill. On the contrary they are more likely to suffer by the competition. The public are being misled by the fabrications of newspaper men, who are ignorant of their subject, just as they were led to believe, through sensational reports, that, with the coming of Mond gas, they would have gas on tap at 3d. or 4d. per 1000 cubic feet for all ordinary purposes. If it is "entirely" a matter of price, then the Gas Companies of London, even if this great power scheme passes, are not approaching the day when they will have been sent into everlasting oblivion. The public have something more to think about, and that is the effect that the scheme will have upon London by another upheaval of its streets, and by the dangers it will introduce underground. The "electrification" of London sounds well; but there are lively times in store by its being carried too far. What caused the fire at the City telephone exchanges? The world knows perfectly well now. The public who have built their hopes on the flimsy base of sensational journalism will perhaps have an opportunity of finding out how they have been deceived; and perchance Parliament will take the necessary step to prevent that opportunity by rejecting the Bill. We hope so. The deception of the public can do no lasting harm; but the handing over of the Metropolis to the new promoters may do irretrievable injury.

Gas Managers as Municipal Councillors.

In the "JOURNAL" last week, we noticed the election of two managers of gas companies—Mr. Stevenson, of Long Eaton, and Mr. Brockway, of Cleethorpes—as members of the governing bodies of their towns. We are pleased to add that Mr. Herbert Lees, the Engineer and Secretary of the Hexham Gas Company, and Hon. Secretary and Treasurer of the North of England Gas Managers' Association, was re-elected as a member of the Urban District Council for the next three years. In acknowledging the continued confidence of the ratepayers in him, he assured them that it would be his endeavour to render them the same faithful service in the future that he had done in the past, and do his best for the good of the town.

Measuring the Underflow of Water.

According to "Engineering Record," the method of measuring the flow of underground water invented by Professor Charles S. Slichter, of the United States Reclamation Service, has been employed extensively by Mr. Homer Hamlin at Los Angeles and in the San Fernando valley. As a result of his experience, he makes the following suggestions concerning the method: (1) The location of the section where it is proposed to test the underflow should be carefully studied. It should, if possible, be in a straight stretch of the valley, and at some distance, either up or down, from large tributary streams. (2) The form and slope of the water table should be ascertained, and the line of test stations should be placed most advantageously. (3) In order to secure accurate results, the testing-stations should be close together along the line of the section. (4) The well screens should be short, and the ground should be tested at intervals of 2 to 4 feet in depth, down to bed rock when practicable. (5) If possible, the porosity of the pervious beds should be determined. (6) In making deep tests, some form of drive pipe and screen should be used. (7) Recording ampere meter and switch clocks should be employed. The discharge from a given section will undoubtedly be far less than is expected; the popular tendency being to very greatly overestimate the amount of underflow.

PUSHING ELECTRICITY.

Considerable activity is noticeable among companies interested in the sale of electricity. Not content with the opportunities afforded by the show on a national scale to be held in London in the autumn, they are seeking to improve the occasion by means of local exhibitions in the smaller towns. This may arise partly from the successful outcome of the Earl's Court Gas Exhibition; but probably loss of business due to the extended use of incandescent gas-burners is not unconcerned in the matter. As much may be safely concluded from a perusal of the leaflets and pamphlets issued in connection with a travelling show that is at present starring in the South-West of England, doing a week at each town, and which has lately visited, among other places, Dorchester, Frome, Salisbury, and Weymouth. These not only present the usual specious pleas on behalf of electricity, but are somewhat sarcastic, if not virulent, in respect to coal gas. For some time electricians appeared to suffer from the delusion that no appliance better than an iron fishtail or batwing burner in a bad state of repair was available as a means of producing light from gas. They have now become aware of the existence of mantles and Welsbach burners; and after a time they may perhaps learn that a table extracted from a work on chemistry published in 1887 is not a fair and honest presentment on behalf of coal gas as at present used. When the reader is told that, in order to get a light equal to 12 candles from coal gas, he must consume 5½ cubic feet of oxygen per hour, he can, if he happens to know anything about gas, form some idea of how far it is safe to accept other statements advanced.

The arrangements in respect to the exhibition have been carefully and skilfully planned; and a very ingenious scheme has been hit upon in respect to admission. A charge of sixpence per head is made; but it is announced that the whole of the takings will be handed over to a local charity. By this means, the Electric Supply Company secure, without costs to themselves, the sympathy of the local Press, who are willing to write up anything that will assist the finances—usually none too flourishing—of the hospital or infirmary. The President or Chairman of the institution, himself a person of no small local importance, is willing to attend the opening ceremony, press the button, and recommend patronage of the exhibition; being directly interested in the number of sixpences taken at the doors. Then to the attractions afforded by the various applications of electricity is added that of a good instrumental band. There are no sit-down lectures or demonstrations, but there is a liberal distribution of paper—not only illustrated price-lists, but also a great deal of matter of the ingeniously informative kind, especially directed towards inducing a call at the office of the Company. The character of the enterprise is at once evident on entering the building. The visitor is assailed on one side by a pretty nurse in uniform, who aggressively jingles the contents of a large money-box bearing the title of the charitable institution concerned, in the hope that the sixpence just paid at the door may be supplemented by a further gratuity; and on the other is the inquiry office of the Company with every facility for taking orders. A charge of one penny is made for a pamphlet entitled a catalogue of exhibits, but which consists mainly of advertisements. There is a short introduction describing the progress of the local Electrical Company in glowing terms, and five or six pages of "Notes on Various Exhibits."

In these notes, as well as in other printed matter alluded to, a noticeable departure is observable. Hitherto electricity has chiefly appeared before the public as "The Electric Light;" but this special adaptation is now relegated to a back seat, and an endeavour is made to take up a position as a sort of universal provider that is even more necessary in the household than a maid of all work. Three completely furnished rooms are exhibited—a dining-room, drawing-room, and bedroom. They are lighted by electricity, of course; but they are also heated by electric radiators, and there is a stand for keeping dishes hot, a cigar-lighter which avoids the possibility of wax spoiling the cigar, a kettle for afternoon tea, a milk-warmer, shaving-water heater, curling-iron heater, egg-boiler, hot-water jug, flat-iron, &c. Then there is an extensive stand of hospital appliances at which the visitor can become acquainted with the X-rays, the Finsen light, and numerous other appliances. In other parts of the hall there are motors of various kinds, including fans, washing machines, pumps, printing, wood working, and other machines. Our old friend the prismatic fountain also re-appears under a new title, "The Electric Fountain."

As regards the cost of electricity for heating and motive power, there is a discreet silence; but in regard to lighting it is stated that an 8-candle lamp costs ⅛d. per hour, a 16-candle lamp about ¼d. per hour, or a 40-candle Nernst lamp at about the same cost. It has frequently been set forth that electric light costs six times as much as gas; and according to these figures this proportion has not been substantially reduced.

An article of moderate length appears in "Technics" this month from the pen of Mr. Thomas Holgate on the subject of "The Manufacture of Sulphate of Ammonia." Various types of plant are concisely described, and notes follow on the process of manufacturing sulphate.

MEMORIAL TO THE LATE MR. RICHMOND.

The sad circumstances attending the death of Mr. E. W. T. Richmond will be in the recollection of many of our readers. In August, 1902, he met with a cycling accident near Penzance, which resulted fatally after a fortnight of unconsciousness. As a tribute to his memory, a stained glass window has been placed in St. Helen's Church, Darley Dale, and will be unveiled next Thursday; the dedication service being conducted by Canon Atkinson. The window is situated in the north side of the church;

and, as will be seen from the illustration, the subject of the three centre panels is "The Resurrection of Christ"—the wording underneath being—

"He is not here." "He is risen." "As He said."

The four smaller panels represent Joseph, Caleb, Joshua, and David. The inscription is as follows:—

To the Glory of God
and
In Loving Memory of Edmund Walter Tyrrell Richmond.
Born June 29th, 1864.
Died by Sudden Accident, Sept. 4th, 1902.

"Ye know neither the day nor the hour."—Matt. xxv., 3.

Underneath, a tablet records that the window is "The Gift of his Staff and Employees." The window is the work of the well-known firm of Messrs. Powell and Co., of Whitefriars, London.

OBITUARY.

We regret to record the sudden death, last Friday, of Mr. William Baker, the Chairman of the Guildford Gas Company. Deceased was attending a dinner of the Company's employees, and was in the act of proposing a toast when he was seized with apoplexy, and died shortly after his removal to his home. He was a member of the firm of Messrs. Bowyer and Baker, corn merchants, of Guildford, a county Alderman, and a borough Magistrate.

The last number of "Le Gaz" contains an announcement of the death of M. Lencauchez, a French gas engineer whose name is well known in connection with his system of constructing generator furnaces. He was a member of the Société Technique, having been admitted in 1878; and in 1881 and 1886 he read papers on the subject of the heating of retorts. These were followed by one in 1889, in which he gave the history of retort-bench construction. At the meeting of the Society in 1902, he presented a very interesting paper on the use of gas coke for industrial purposes generally; and in the following year he offered some

observations on the effect of the sulphur in the pyrites of solid combustibles in their transformation into gaseous fuel in generator furnaces.

The citizens of Birmingham sustained a great loss last Thursday evening by the sudden death, as the result of an apoplectic seizure, of Councillor ROWLAND HILL BERKELEY, the Lord Mayor. He was in the act of conversing with two medical men, one of whom had been spending the evening with him, when he fell back in his chair, and died within a few minutes. The sad event, which has profoundly touched the whole city, calls for notice here, as the deceased did excellent service on the Gas Committee of the Corporation. When Sir Hallewell Rogers was elected Lord Mayor in 1902, Mr. Berkeley became Chairman of the Works Sub-Committee. Mr. Stevens, a colleague of Mr. Berkeley upon the Committee, in nominating him as Lord Mayor last November, stated that "in the office of Chairman of the Works Sub-Committee there had been no more devoted servant of the Corporation than Mr. Berkeley." "Had the business," he said, "conducted by the Gas Committee been his own, he could not have given closer attention to it; and the city owed him a great debt of gratitude." The utmost sympathy is felt for the Lady Mayoress and the family in their severe bereavement. Deceased was 54 years of age. It was arranged that the funeral should take place yesterday, and, in deference to the express wish of the Lady Mayoress, be of a private character.

PERSONAL.

Mr. T. EBENEZER PYE has been appointed Engineer and Manager of the Chichester Gas Company, in succession to Mr. R. S. Church, who has resigned.

At the meeting last week, at Wakefield, of the Provincial Grand Lodge of West Yorkshire, the Provincial Grand Master (Lord Allerton) appointed as Prov. S. G. D. Bro. J. W. BROADHEAD, of Elland.

At the last monthly meeting of the Reading Town Council, Mr. LESLIE C. WALKER was, on the recommendation of the Water Committee, appointed Water-Works Manager, in succession to his father, whose death on the 3rd ult. was noticed in the "JOURNAL" at the time. Mr. Leslie Walker was for some years Chief Assistant; and his promotion to the higher office is subject to reconsideration at the end of twelve months.

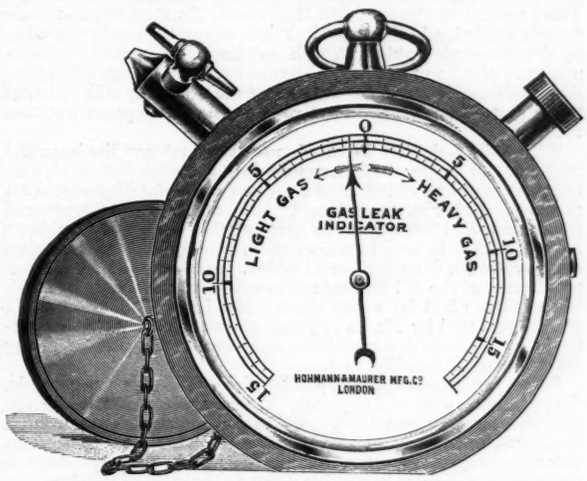
At a special meeting of the Directors of the Derby Gas Company held last Thursday, a letter was read by the Deputy-Chairman (Colonel Gascoyne) from Mr. HENRY SWINGLER, D.L., resigning his position as Chairman of the Company in consequence of continued ill-health. Mr. Swingler has been a Director of the Company for twenty-one years, for fourteen of which he has been Chairman. The Board accepted the resignation with deep regret, and placed on record their high appreciation of Mr. Swingler's valuable services to the Company, and expresssed the hope that he might be spared to enjoy a long period of repose, undisturbed by business care. Colonel GASCOYNE, J.P., has been appointed Chairman, and Alderman NEWBOLD Deputy-Chairman, of the Company.

At the meeting of the Rotherham Corporatjon on Friday, Mr. J. S. NAYLOR, the Superintendent of the Rochdale Road Gas-Works of the Manchester Corporation, was appointed Engineer and Manager of the Rotherham Gas-Works, in succession to Mr. F. A. Winstanley. Mr. Naylor, who is 36 years of age, received his early training for the gas profession at Cleckheaton, where he passed through every branch of the business. On the completion of his articles, he was engaged for a few years as Assistant to the Engineer (Mr. G. H. Niven) and in 1892 was appointed Engineer and Manager of the Selby Gas-Works, where he effected great improvements in the plant. Two years later he was selected for the position of Manager of the Droylesden works of the Manchester Corporation, where he devised and carried out several important experiments with inclined retorts and regenerator firing. In 1898, he was appointed Deputy Engineer and Manager of the Bradford Road works, and in 1901 was entrusted with the management of the Rochdale Road station. Mr. Naylor having had special experience with inclined retorts, he was secured, as mentioned in the "JOURNAL" last week, to give evidence on behalf of the plaintiffs in the important action now being tried by Mr. Justice Grantham. We congratulate him on his appointment at Rotherham, and cordially wish him success in the discharge of the duties appertaining to it.

By a majority of 68, the House of Commons last Thursday rejected the Bill promoted by the London County Council to give them control over the Port of London; and the Association of Waterside Manufacturers have consequently been relieved of one object of their opposition. The scheme of the Council was strongly objected to by the City Corporation. The rejection of the Bill was moved by Lord A. Compton on the ground that it was an attack on private enterprise which had made the Port of London the finest in the world. In seconding Lord Compton's amendment, the Hon. Alban Gibbs said he viewed with great fear the removal of the management of the Port from the hands of the able men who now have charge of it; and this view prevailed with the majority of the members.

HOHMANN AND MAURER GAS-LEAK INDICATOR.

The methods usually employed to trace the source of gas leaks are often expensive, dangerous, and unsatisfactory. A leak may be reported in a street, and the ground opened; but the odour may travel through seams in the earth or through old trenches, and come to the surface at considerable distance from the leak. This is attended with expense. Again, a suspected gas leak has proved to be the odour arising from pouring the liquid from street syphons into the gratings—the drains and house traps being faulty—permeating the houses. A leak adjacent to a subway, sewer, or vault is dangerous to locate with a flame. At the works it is often hard to satisfactorily determine if a holder emptied for repairs still contains gas or only an odour of it. The unaccounted-for gas at the works is usually a factor of considerable importance, and is due in part to leakages which are difficult to locate. An instrument that will quickly and accurately reveal the presence of gas is therefore in the highest degree valuable; and the one shown in the accompanying illustration possesses the special advantage of indicating if the gas is light or heavy.



The construction of this gas-leak indicator is based on a well-known scientific principle—that of the diffusion of gases; and its mechanical application is effected by the employment of an elastic metal chamber, the bottom formed of a porous tile through which the diffusion takes place. When the indicator is brought into an atmosphere charged with gas, the gaseous atoms diffuse through the tile into the closed chamber with greater rapidity than the enclosed air passes out—thus causing pressure by increased volume upon the elastic surface of the chamber; and the motion thus given is communicated to mechanism which causes the index hand to move over the dial. The maximum effect of the gas is attained in two or three minutes, when the index hand ceases to move.

In order to locate a leak, the usual procedure is to make three holes, 15 or 20 feet apart, in the street pavement over the line of the main. The indicator is then placed in these openings with the porous tile downwards; any space around the instrument being filled in with clay to prevent the leakage of gas into the air instead of through the tile. The difference in pressure shown upon the dial at these places will indicate the direction of the leak. The tests are continued in the same manner in the direction which indicates the greater volume, until the instrument shows the maximum amount of gas, which proves the location of the leak.

The tap and valve are left open until an observation is about to be made. Before being placed in a suspected atmosphere, or where gas is to be measured, the valve is closed, and the brass cap placed over the porous tile. When actually within the gaseous atmosphere, the cap is removed. The tap being opened after the test has been made, the index will immediately return to zero. The indicator should be placed in the air for a few minutes to purify, when it will be ready for another observation. The object of the valve, in addition to the tap, is to cause the chamber to purify more rapidly. If the indicating hand moves to the left, it denotes a pressure of gas lighter than air; if to the right, a gas heavier than air. If a gasholder emptied for repairs is to be entered, the indicator will instantly show whether gas or only an odour still remains in the vessel. The same applies to subway conduits, &c., and where workmen must enter.

The indicator we have illustrated and described was, it may be remembered, shown at the Earl's Court Exhibition by the Hohmann and Maurer Manufacturing Company, of 98, Clerkenwell Road, E.C. The same firm have other specialities which we intend to notice in due course.

Among the lectures to be delivered at the Royal Institution after Easter are three on "Flame," by Sir James Dewar, the Fullerian Professor of Chemistry at the Institution.

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

Meeting at Leighton Buzzard.

The Thirty-third General Meeting of the members was held at Leighton Buzzard last Thursday, under the presidency of Mr. J. S. DOUGALL (Boston). This part of the Association's extensive district has not before been visited by the members, and, notwithstanding that it was inconveniently situated for some, the attendance was a very representative one. Assembling at the gas-works soon after noon, the members were received by the Chairman of the Gas Company (Mr. Robert Richmond), two of his colleagues on the Board (Mr. George Garside and Mr. J. H. Green), the Engineer and Secretary (Mr. C. F. Ruggles), and the Auditor (Mr A. Collier). Their first act of hospitality was the provision of lunch on the works; and later in the day, at the dinner, they again contributed largely to the entertainment—in fact, to them and their influence the arrangements for the day were of an order which placed the meeting second to none of its predecessors in the amount of delight that it afforded the visitors. The personal kindness of Mr. Richmond, Mr. Ruggles, and their friends was indeed unbounded. There was an informal inspection of the gas-works, which, though not large, are a model of simplicity in plant and method, nevertheless yielding high efficiency. Some information as to the progress of the Company will be found in the paper that Mr. Shadbolt read at the subsequent business meeting.

Who visits Leighton Buzzard, and does not see the beautiful mansion and estate of Mr. Leopold de Rothschild, loses a charming sight, and one which once seen can never be displaced from memory. But who sees "Ascott" can only do so by the grace of the owner; and from him the hosts of the visitors were able to readily obtain it, and to escort them through the grounds and conservatories, the grandeur of which, together with the distinctive beauty of the old and extensive mansion, could only be indifferently described by words alone. Mr. Leopold de Rothschild was represented by Mr. John Jennings, who was extremely courteous in leading the members over the estate, and in giving information of unending interest.

Before the large and pretty pavilion facing the pleasure grounds, the members were subsequently photographed; and inside the business meeting was held. But in the midst of such beauty, there was a little incongruity in talking of such plain matters as commerce and engineering construction; and, in truth, there was some slight difficulty in settling down to the duty of the day.

THE BUSINESS MEETING.

On the PRESIDENT taking the chair, the proceedings immediately commenced by

The HON. SECRETARY (Mr. Thos. A. Guyatt, of Ely) reading the minutes of the last general meeting held at Boston on Thursday, Sept. 22 last. They were unanimously confirmed.

ANNUAL REPORT AND ACCOUNTS.

The report and accounts of the Committee for the past year were next presented; the former being for the most part an outline of the proceedings at the meetings held at Peterborough, Boston, and Earl's Court. Among other information, it was learned that the year commenced with a membership of 88. One member died during the year, two resigned, and one severed his connection under rule 19. Nine new members were elected, and one who had previously intimated his intention of resigning afterwards withdrew his resignation, making a total membership at the end of the year of 94. The accounts show that a balance of £47 5s. 11d. was brought forward, and that the subscriptions paid during the year amounted to £46 14s. 6d.; making a total of £94 0s. 5d. The expenditure was £40 4s. 4d., which leaves a balance in hand of £53 16s. 1d., and a few subscriptions outstanding. The Committee also reported that affiliation with the Institution of Gas Engineers, which was agreed to by the Association at the spring meeting, had since been accomplished by resolutions passed and confirmed at special meetings of the Institution; and the Committee, acting on the members' behalf, had elected Mr. J. S. Dougall to represent the Association as the first affiliated district member on the Council of the Institution. This course was necessary, owing to the date of the spring meeting being too late to allow the requisite notice to be given if the election had been deferred till then.

Mr. H. WIMHURST (Sleaford) moved the adoption of the report and accounts; remarking that one very satisfactory feature of the latter was the increase in the amount standing to the credit of the Association.

Mr. F. PATERNOSTER (Felixstowe) seconded the motion, which was unanimously carried.

ELECTION OF NEW MEMBERS.

On the proposition of the PRESIDENT, seconded by Mr. E. J. BROCKWAY (Cleethorpes), the following gentlemen were added to the roll of membership: Mr. John West, of Stamford; Mr. William Hargreaves, of Long Sutton; and Mr. John Thomas High, of Sutton Bridge.

Mr. R. G. SHADBOLT (Grantham), called upon by the President to read his paper on "The Commercial Aspect of Technical Societies," observed that this contribution was the result of the acceptance of the honourable position of Vice-President. By way of encouragement to those who had something to bring forward, he should like to point out that it was an unwritten law in the Eastern Counties Association that the Vice-President should once during the year he occupied the office make a contribution to the proceedings. Hence the paper. They could not write just as they liked a paper to order; and this was the condition under which this production was forced from him. The paper was as follows.

THE COMMERCIAL ASPECT OF TECHNICAL SOCIETIES.

Much has been said and written of late concerning educational matters in the world of gas technics. As this has reference solely to the training of those who are expected to don our mantles of responsibility when they no longer sit lightly upon us, it is not the writer's intention, in the present instance, to contribute to the multifarious schemes and notions set forth on this subject from time to time, but rather to venture a few remarks upon the necessities of the present time, and upon the conditions under which responsible gas management is now labouring. The very existence of the many technical societies with which our country is strewn is outstanding evidence of that spirit of self-help and self-instruction, or, rather, should we say, mutual help and mutual instruction, which is one of the characteristics of our race; and to the man who considers his education complete upon emerging from his studentship—if such there be—this feeble effort makes no appeal. On the contrary, it is addressed rather to those who recognize the educational value of the very type of society to which we here belong—particularly to men actively engaged in the business conduct of affairs involving technicalities.

To keep pace with the advances and application of contemporary scientific knowledge, even so far only as it affects one's own business or profession, is to cultivate a mental attitude of a most receptive character, sufficient to entitle one at the close of life to the epitaph of one of our country's philosophers, of whom it was said, "He died learning." It may be accepted as a general rule that commercial considerations have been the impelling forces in the formation and conduct of technical societies; and it is but logical to expect the benefits accruing from united technical action to express themselves in commercial results—in other words, they must be judged by commercial standards. We should look for their impress upon the cost of production (be the commodity what it may) on the one hand, and the resultant effect upon the market on the other—this latter extending or restricting its sphere of usefulness, as the case may be, and thus determining the reflex effect upon the particular industry, or branch of industry, itself.

The inclination to produce something of our own personal effort is innate in human nature, and has immediate beneficial effects upon the producer himself; but to produce and contribute to the general fund of usefulness that which is of service and increasing usefulness to others, is of surpassing value to all concerned.

It is not long since many of our technical societies were wont to pride themselves upon their exclusiveness, not only of membership, but of subject-matter also; and to suggest the introduction of purely commercial considerations, however relevant they may have been, was to incur the odium attaching to the rankest heretic. But to-day it is evident to the most casual observer that a change has come o'er the spirit of the scene. Ability and ingenuity in design and skill in construction are no less requisite in the engineer now than in the past; but unless the fruits of these efforts are carefully conserved, and all ancillary methods and distributive systems are calculated to assist in the main design, constructional and productive ability avail little. In many industries, particularly those of vast magnitude, the technical and commercial must, owing to human limitations, be placed under separate heads. Yet, even in such cases, we generally find one organizing head, who directs and combines the efforts of the two branches. In our own particular industry, the various departments of any one undertaking are so dovetailed and interdependent, and its sphere of operations so circumscribed with regard to locality, that its successful conduct is generally best achieved by one dominating spirit.

The gas "manager," as distinct from the "engineer," is of the more vital importance to the well-being of the undertaking at the present time. The days when the manager's responsibility practically terminated at the holder, tar-well, and coke heap, have departed never to return; and as these are but the initial stages in a system of complete management, so is the technical education of to-day but the initial stage in the complete equipment of the technical manager. The commercial bearings of our operations cannot be fully grasped save through the hard school of actual experience, and many an undertaking has been compelled to submit, with the best grace possible, during the novitiate of its responsible manager, and until such time as he has learned the use of the commercial reins and acquired the experience requisite to give him the necessary control. Followed to their logical conclusion, societies such as ours are the only ready mediums for

disseminating this managerial knowledge; and it is because this branch of usefulness has not been utilized as it might that this question is placed before you to-day.

We could scarcely expect this from such societies as the Institution of Civil Engineers and others of our leading technical societies, as, generally speaking, their interests as societies are confined to design, construction, and production—the purely commercial applications being too conflicting to permit of mutual confidences. Yet, particularly in regard to production, we note the same change taking place as in other quarters—viz., increasing attention to financial considerations, especially the reduction of prime costs, &c. Indeed, the basis of all these societies is community of interest; and when this ceases, the usefulness of any technical society reaches its limitation, and not before.

In a general way the various bodies we should class as technical societies may be divided into two groups—one, those whose efforts are naturally confined to the scientific, mechanical, or technical aspect of the interest they promote, in some cases restricted to one industry, in others spread over a number; the other, those whose operations are of such a nature as to apply to the whole range of activity of the industry or industries whose interests they serve. It is in the latter group that we must place the different gas societies of the country, from the Institution of Gas Engineers downwards, but more particularly the District Associations.

One is well aware that in thus defining our position he is not presenting any new feature, or propounding any new principle, but is, on the contrary, laying himself open to the charge of reiteration, more especially, perhaps, in the case of this Association, whose avowed object is "to devote itself to the advancement of all matters connected with gas engineering, manufacture, and finance, and to facilitate the exchange of information and ideas among its members."

That the advancement of gas finance and the exchange of "commercial" information have not been so zealously sought as the remaining object is common to other similar bodies as well as ours; and the fault may generally be laid to our interpretation of such terms as "finance" and "information," which subjects have certainly been held subservient to, rather than equal with, the remaining object. The recent presidential utterances of Mr. S. Meunier, the President of the Manchester District Institution of Gas Engineers, dealing almost exclusively with the commercial aspect of gas affairs, are significant as indicating the present trend; and his discernment, in thus interpreting the needs and tendencies of the times, is to be commended.

Who of those who have had any length of experience of the working of our District Gas Associations but knows that oftimes more real benefit is derived by individual members, on matters of present interest to them, through a confidential or semi-confidential chat, than from the more ambitious and official transactions? It has always been the writer's retort to those who are content to avail themselves of the transactions of such bodies, as published in the Technical Press, without in any way contributing to the same, that, whatever benefits they may derive from their perusal, they altogether fail to appreciate the advantages of social intercourse with those present in person. And as our responsibilities have broadened from those of mere gas suppliers to purveyors of light, heat, and power, in a variety of forms, and the problems to be faced have become more complex, so has the necessity for intercourse of a more confidential character than our public meetings afford become more pronounced.

It is worthy of note that the immediate cause of focussing this felt want into organized action was the disposal of the chief gas-works residual, coke, which has such an important bearing upon the cost of our prime product. A few gas managers in the vicinity of Manchester, finding this question pressing hardly upon their respective undertakings, began, first, to compare notes occasionally, with a view to a better understanding of the markets in which this commodity had to be disposed of. This simple comparison of notes quickly developed and extended, until regular returns comprising the requisite information were formulated, and in turn distributed to those who contributed thereto. If ever the old adage, that "Knowledge is power," was verified, it was in this instance; for instead of meeting the markets blindfold, one had now sure information at hand, sufficient to enable him to appraise the actual present value of his ware, and, further, its probable rise or fall, as indicated by the increase or decrease of stocks. It needs no effort of the imagination to see that the value of such mutual confidence once demonstrated, other items were soon brought under purview, with similar beneficial results. Indeed, this system once inaugurated there is no subject affecting the financial welfare of any gas undertaking which cannot find a place for consideration, or an instance in point.

As can be readily understood, the Manchester District Institution of Gas Engineers were not slow to note the importance of this movement, and promptly absorbed it within their own organization. The district covered by the Manchester Association was divided into four Commercial Sections, each section being independent of the others, but giving an account of its stewardship to the Institution at stated intervals. These four sections, by natural processes, gradually resolved themselves into two Commercial Sections, into which the district covered by the parent Institution is now divided. That these sections have fully justified their existence is exemplified by the keen interest taken in their proceedings by all the members, and by the commercial information of many kinds placed at their disposal, as affecting coal, coke, tar, liquor, sulphate of ammonia, labour, superannuation, street lighting, incandescent lighting, fittings and maintenance, Gas Acts, rating, testing, advertising, insurance, &c. As the members of these two Commercial Sections number more than half the membership of the Manchester Institution, and represent an annual output of gas of considerably over 20,000 million cubic feet, you may judge of their utility or otherwise. Valuable as the operations of these two sections have already proved, it is confidently anticipated, by those in intimate contact with their inner working, that the future will find them increasingly useful to all who avail themselves of their assistance, more particularly those in the early years of responsible control.

Considering that the interests of gas undertakings, whether owned by local authorities or companies, are in the main identical, it is really surprising that the purely commercial side of their affairs should, for so long a time, have remained in a state of isolation; the very factor that has brought about united technical action evidently operating in the opposite direction commercially. This possibly applies with more force in districts such as ours than in the more populous neighbourhoods. However that may be, this Association has certainly not, as yet, lent itself to any organized effort in this direction, and, in the writer's opinion, it is high time that it did so. Some dozen or so of our members in the northern part of the district have got as far as the note-comparing stage, and meet monthly to exchange information and discuss any question of immediate interest to any one of them. That we have all derived some benefit is to state the case midly indeed. Some undertakings are decidedly the better for it; and this is attributable to nothing more than the exchange of confidences, with a consequent better understanding on points of mutual interest—knowledge replacing ignorance, and certainty supplanting surmise; with decrease of waste effort and of overlapping, and power to discriminate, as the immediate results. Sufficient progress has been made to indicate to those interested that this is a movement in the right direction, and one which might be usefully extended to the whole district.

There may be some stalwarts of independent nature who would benefit little from such a movement; but they would prove to be a very small minority—indeed, the self-contained man is yet to be discovered. The principal obstructionist so far is certainly he who is fearful of giving more than he receives; also the management of some of the larger undertakings would appear to confound magnitude with knowledge and wisdom. Again, there are those who perceive the possibility of developments in the direction of "rings" to force prices, &c. Very little consideration will dispel this latter idea, as, in the very nature of things, we are much at the mercy of outside markets with such commodities as we have to place upon them. We cannot control our output of residuals (say) to suit demands; but we can avoid useless and wasteful overlapping and consequent loss.

To those who have associated themselves with this movement, it has often been matter for much surprise to note the number of undertakings which are so wedded to wont and custom—not in any one particular—as to be literally throwing money away; the gradual discovery of such maladministrations and their rectification being among its first fruits. In practice, its action may be regarded as (first) the consolidation of individual undertakings, and next the development and extension of business operations generally.

To the manager who finds himself in charge of a moribund undertaking, or obsolete plant, or is called to labour under antiquated systems of administration, as also to him who is taxed with an abnormal rate of increase in business—and we find all these within our borders—a purely commercial association with his fellows is equally beneficial. It is but repeating a truism to say that times and conditions are altering; yet a full appreciation of the fact cannot be too vividly enforced. Organic changes are effected gradually, alike in the vegetable, animal, and business worlds; the subjects of those changes being least aware of the fact until, in the case of conscious organisms, some definite stage of development is reached, and the fact borne home. That the period of transition in which we find our industry is by no means ended is evident to every observer, and that the commercial, as distinct from the technical, aspect must receive much more attention than hitherto, is but the outcome of the transition now in course of progress.

Imagine the dismay that would have overwhelmed the management of many gas undertakings (say) twenty years, and in many instances a much shorter period, ago, had many present-day methods been seriously suggested. One instance in point. An undertaking known to the writer has been gradually led, by the exigencies of the times, to adopt first one and then another modification in its methods, until the effect of merely nominal rents for appliances, fittings, and other work, done rather to accommodate the consumer than to yield a profit, and the sweeping aside of various obstacles to extending and developing business, &c., has involved a tax upon revenue account, as compared with a period of less than ten years ago, of over 3d. per 1000 cubic feet on the total quantity of gas sold.

Take another instance of a different nature, but having a direct bearing upon the cost of manufacture, arising out of the arsenic scare. In this case, malting customers who were accounting for from 50 to 60 per cent. of the total coke sales suddenly withdrew their patronage. As you are well aware, many others were

similarly affected, and a slump ensued, with results little short of disastrous. With unremunerative outside prices, the study and development of the home market became imperative; and here a little friendly comparison of notes with others similarly circumstanced was most useful in elucidating the situation. Result: The cultivation of the home market by means of coke specially prepared for both domestic and trade purposes, until now, I understand, the sale of specialized coke in that town equals about 40 per cent. of the total sales. And so one might continue to enumerate, were not similar examples too well known to our members to require emphasizing further.

One thing stands out clearly—viz., present requirements cannot be sufficiently met on the old lines; adaptability is the order of the day. The undertaking under whose auspices we are assembled to-day is a good example of that vigorous vitality we have been accustomed to associate with our industry. From a few particulars supplied to me by Mr. Ruggles, one can readily see that the management is imbued with that spirit of commercialism without which such progress would have been impossible.

LEIGHTON BUZZARD GAS COMPANY.

Progress over Twenty Years.

	1884.		1904.
Coal Carbonized	1700 tons	..	4185 tons.
Gas made, cubic feet	17,100,000	..	44,596,000
Price of gas per 1000 c. ft	4s. 3d.	..	3s. & 3s. 9d. (now 3s. 7d.)
,, ,, for engines	—	..	3s.
,, ,, for public lighting	—	..	2s. 7d.
Additional price to slots	—	..	4d. per 1000 cub. ft.
Amount received for gas	£3615	..	£9150
,, ,, coke	£449	..	£1504
No. of ordinary consumers	450	..	612
,, slot ,,	—	..	830
,, cookers	—	..	881 { 665 slots / 226 ordinary
Dividends paid, per cent.	8	..	10

The foregoing progress, be it noted, has been made with practically a stationary population. Although these figures are not intended as an analysis in any way, they are fully sufficient for our purpose. Note the outstanding features—viz., 57½ per cent. of the total consumers on the slot system, and 61 per cent. of the total consumers using cookers. Of the 881 cookers, 655 are in use with slot meters, demonstrating the fact that not only has the prepayment meter been an invaluable aid in securing new consumers, but, as in so many other cases, has proved itself the principal medium in introducing gas-cookers. May I direct your attention for a moment to the last published "Gas World" Year Book? In the summary of the directory portion of that annual, it is shown that there are 1615 gas undertakings in the United Kingdom, supplying nearly 5 million consumers, 30 per cent. of whom use gas-cookers, while 32 per cent. are supplied through prepayment meters. Of these latter, 191 undertakings supply 50 per cent. or more of their consumers by the prepayment system, thus:—

120	supply through	slot meters	50 to 60	per cent. of	total consumers
46	,,	,,	60 to 70	,, ,,	,,
17	,,	,,	70 to 80	,, ,,	,,
8*	,,	,,	80 to 90	,, ,,	,,

* These eight undertakings have consumers ranging from 234 to 8682 respectively, or an average total of 2612.

Looking over those undertakings that have been generally known as being among the earliest to adopt the prepayment system, it would appear that 60 per cent. of the total consumers is about the average proportion among them. From this we may scarcely expect the saturation point of the whole country to exceed 50 per cent.—no very distant event—considering that it now stands at 32 per cent. One may be forgiven the question, And what then? A fairly regular rate of increase over the whole industry is the first condition of success; and, from our past experience, one may reasonably expect that the means will always be forthcoming. But certainly not without strenuous effort in every department.

Not many years ago, directors, committee-men, and managers alike, were generally agreed that any advantage in the price of gas supplied should be given to the largest consumers, irrespective of the purpose for which it was required, the regularity or otherwise of the demand, or the season at which the maximum requirements were likely to occur. Considerable modifications of these views have taken place of late, as we have gradually realized that our prime product must be regarded more as a means to an end than as an end in itself. Our unit is transposed from a given quantity of gas to the energy contained therein, as expressed in light, heat, and power; and so long as either of them continues to bring grist to the mill, it must be placed upon the market at prices suited to its requirements, each of these separate uses of gas being treated as a separate and distinct field for exploitation. Each of these fields has a separate and distinct standard of comparison, and, moreover, the varying applications of gas in any one of these fields may again require different treatment.

By means of the incandescent mantle, now applicable under almost any conditions of service, the bunsen burner undoubtedly holds sway in the lighting field, and even where the price of gas is comparatively high, the reduced cost of light to the consumer by this means is infinitely greater than any economies in production could ever have effected. By way of contrast, note the use of gas for power purposes. Here we enter into very active competition with several methods of attaining the desired end; and in fixing the selling price of gas for this purpose far more consideration must be given to the cost of other systems than to the claims of the consumer on account of quantity, &c.

Turning to the heating question, we may safely claim that gas for cooking purposes holds the field, and is both economical and efficient at all ordinary prices. Not so, however, with the use of gas heat for some other purposes, as in gas-fires and some industrial appliances. Yet if these sources of gas consumption can be developed in any quantity, it is business that we cannot afford to overlook and that will prove well worth the cultivation. Still, speaking generally, the development of the gas-fire business has not been undertaken in anything like the same spirit as the cooker business, and those who have given the matter attention would appear to agree that some special inducements must be offered if this particular field is to be thoroughly exploited.

The writer has heard it argued that gas-fire consumption is likely to be the greatest at the period of ordinary maximum demand, and, as a consequence, would prove an undesirable addition. If the hours of heating corresponded with those of lighting only, there would be some weight in the argument. Very little reflection will show this view to be erroneous. If gas heating of dwellings, shops, offices, &c., became general, it would be pre-eminently a day load, and would assist in levelling up the winter day load as the cooker now does the summer day load—indeed, as a day consumer, it should prove much more regular throughout the day than the cooker. As an evening consumer, where gas is used for lighting, experience proves that the gas-fire is required less than during the daytime, and, of course, the closing of offices, &c., would likewise lessen the use of gas for heating purposes at that period; and the extended use of bedroom fires would serve to improve what is still, and likely to remain, the period of minimum consumption.

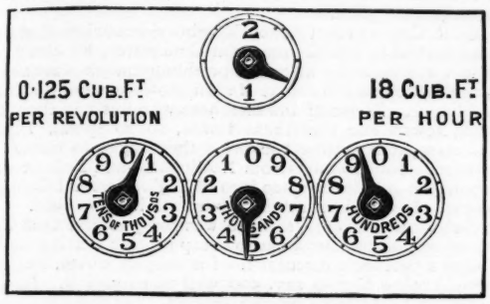
Moreover, we must not lose sight of the fact that with the development of the incandescent burner on the one hand and the increasing use of cooking, &c., appliances on the other, the balance of maximum and minimum demand has been entirely altered. In Grantham, ten years ago, the maximum week's output was, roughly, four-and-a-half times that of the minimum, whereas now it is but twice that of the minimum; the latter having increased, and the former, after reaching a certain stage, decreased. Thus a plant laid down for a given annual make is, under the altered conditions, equal to some 20 per cent. greater annual output than it was originally designed for; and would, of course, be more economically employed were the maximum demands more nearly approaching the generating capacity—*i.e.*, at the proportions of 2 maximum to 1 minimum. At any rate, the plant is there; and it would involve very little extra cost to produce a larger quantity of gas than is now required, particularly if that demand was more even over the day and evening.

This is but one of the many important questions which claim such consideration and discussion as can only be adequately obtained in assemblies similar to the Commercial Sections already mentioned. As the prepayment meter has been the main key to the cooker situation, so, I firmly believe, will the discount meter prove to the gas-fire business, offering, as it does, a cheap, simple, and unobtrusive method of meeting special prices and special cases at will, and that in a most acceptable form—viz., a rebate or discount. Given an acceptable system of hiring out gas-fires, and here indeed is the inducement required. Too close attention, however, cannot be bestowed to details before launching this system in any given district. The chief consideration to the gas manager, after that of cost, will naturally be the accuracy of the meter; for reliability must ever be a dominating factor in matters of this kind. The minimum rate of flow below which the "Rotary" meter is not guaranteed to register accurately might, at first blush, appear to militate against it, but in reality this quantity is so small as to be below the range of gas-fire requirements, or even to deserve recognition. However, to determine this question in actual practice, the writer fixed one of these discount meters along with an ordinary 3-light dry meter, taken haphazard from stock, to a 20-foot per hour Kern radiator, the gas passing through the ordinary meter, thence through the discount meter to the radiator, Both meters started from zero. This arrangement was under observation from the latter end of November last to late in March. The room—an office—measured 18 feet by 16 feet 6 inches by 10 feet high. The radiator was turned on and off, as and when required, and gas burned at all rates varying from 25 feet down to 5 feet per hour, according to demand. To enable you to judge of the result, the two meter dials have been photographed and reproduced—see p. 161. The illustration, from a reliability standpoint, clearly speaks louder than words.

Here, at any rate, we appear to have a ready means of tapping a field generally undeveloped. Many instances will doubtless occur to your minds where this instrument will be of service. Indeed, in almost every case where a portion of the general supply to any one consumer calls for a special record, or a special price, this meter stands alone in its utility; provided, of course, that it be made in a sufficient variety of sizes. But, however, serviceable it may prove generally, it is undoubtedly the best aid in the developing of the gas-fire business that has, as yet, been placed at our disposal.

There are, of course, many more live questions to which our best energies must be devoted, and in connection with which

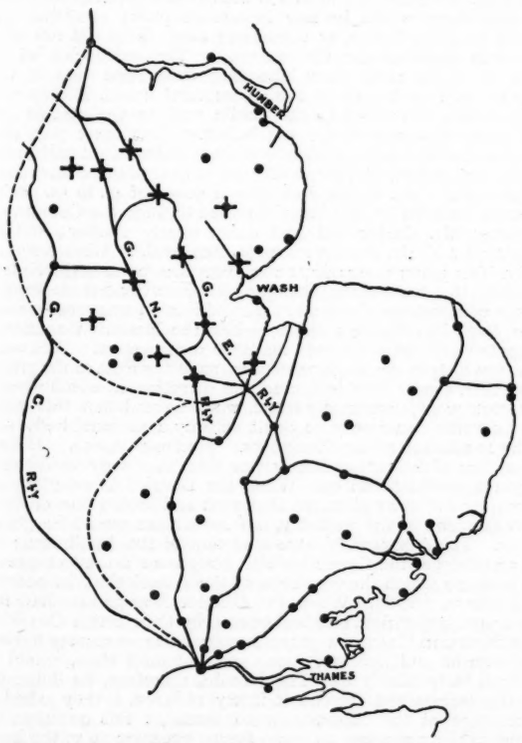
mutual help and mutual instruction are the only educational means available. It has not been the aim of the writer to exhaust these subjects, even in their summary form, but rather to touch upon sufficient material to evoke a profitable discussion, and such as shall result in the adoption of the Commercial Section system by this Association, for the furtherance of the interests of our industry and the benefit of the public we serve.



THE THREE-LIGHT METER DIAL.

THE DISCOUNT METER DIAL.

Before concluding, allow me to direct your attention to the accompanying outline map of the district covered by this Association, showing the geographical disposition of the undertakings represented by its members within that area, and a suggestion for



OUTLINE MAP SHOWING THE AREA COVERED BY THE EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

grouping them into two sections for commercial purposes, as shown within the dotted lines and coast lines. Those places bearing a cross indicate the undertakings whose managers already exchange information at stated periods, as already explained.

Discussion.

Mr. SHADBOLT said he should like to call attention to the fact that they had among them on this occasion Mr. Ogden, a Past-President of the Manchester District Institution of Gas Engineers, who had been, with Mr. Meunier, one of the most active of the promoters of the Commercial Sections of the Institution. He thought possibly the President would ask Mr. Ogden to relate his experiences in connection with Commercial Sections.

The PRESIDENT remarked that the paper had been a most instructive one; and he should be glad to adopt the suggestion of Mr. Shadbolt, and invite Mr. Ogden to tell them his experiences of the Commercial Sections of the Manchester Institution.

Mr. S. R. OGDEN (Blackburn) said he could say distinctly that, since the movement was started in his year of office as President of the Manchester Institution—through his own presidency, that of Mr. Townsend, and now that of Mr. Meunier—generally the result had no doubt been among the Lancashire and Yorkshire concerns exceptionally beneficial to all who had taken part in it. They had a system of sending in their stocks, and their prices, together with contract prices, for the time being week by week. These were distributed among the whole of the members of the Commercial Sections. By this means they worked out very easily the prices which they saw were the equivalent prices for their particular coke; and so they were able to stop price-cutting, which was an important thing indeed. There had been works which had benefited to the extent of 4s. or 5s. a ton on their coke more than they would otherwise have obtained. Of course, the work they had carried on had not ended at coke. They had gone practically into every subject that was of interest to the gas industry; and they had at the present moment compilations of figures and facts which, once put into the hands of the Commercial Sections of the country, would be of great service. There were several points in connection with the paper about which one would like to speak; but he thought he ought to leave them to the members of the Association.

Mr. JOHN CARTER (Lincoln) remarked that the paper referred to a great many topics. Those particularly dealing with increasing the consumption of gas, and the means that developed and led to so desirable an end, were matters about which he had no doubt they had all thought, and to which they had to some extent devoted their energies, with, generally speaking, he ventured to say, favourable and encouraging results. Probably the remarks that had fallen from Mr. Shadbolt on these particular aspects of their business would tend to cause them to endeavour to return still more satisfactory and encouraging figures. But he (Mr. Carter) presumed the one thing in the paper that was new to most of them was the suggestion that, just as they had banded themselves together in District Associations and into a National Institution for the consideration of purely technical matters, they should now extend the idea, and organize for the purpose of making the commercial matters in which they were interested subjects for consideration with the view to co-operation and mutual advantage. Their chief residual product was coke. He had not looked into a single figure on the question; but he thought he would be justified in saying that their revenue from coke would just about equal the revenue from all their other residuals put together. If he took a rough-and-ready average again, and said that one-half of their coal bill was returned to them by the money product of their residuals, and when they bore in mind that coke returned to them half of this total amount, he need not say anything more to impress upon the members or himself how important it was that they should make the very best of their coke market, and not be flinging money away as they had been doing because they had been entirely in ignorance of the position in which they were placed in relation to each other. One result of this had been that they had been sending coke in senseless competition into each other's districts; the only effect being that 3s. or 4s. they might have put into their own pockets had gone into the pockets of the railway companies in the form of railway charges. The information that was available to them all if they, by organization, would only put themselves into communication with each other, as well as by meeting together and comparing notes, would be very interesting and useful in the ordinary experience of the gas manager. He had a lively recollection of a customer coming to him, and asking a price for coke. He (Mr. Carter) gave him very readily a price which he thought ought to secure an order; but with some of that audacity which close buyers were very often in the habit of displaying in their business transactions, the customer told him he should go to one of his (Mr. Carter's) friends, not many miles away, from whom he could buy coke on rail at a much lower price than he was quoting him. By the operation of their little meetings together (to which Mr. Shadbolt had referred in the paper), and by the information they gave one to the other, he happened to know that what this customer was saying was a little bit of bluff; and so he stuck to his price, and got it. In the absence of information (as he happened to be an eager seller of coke at the moment) he might have regarded what the customer said as being absolutely true, and might have been led to reduce the price to get the order when such reduction was absolutely unnecessary. This was an instance where their little Commercial Committee came very useful to him, and similar experiences he had no doubt had occurred in the history of several of his friends. Not a fortnight ago, his Chairman went to him and said: "We are charging too much for our coke." He (Mr. Carter) answered that he did not think they were. Then his

Chairman said he had information on the subject, and told him the selling prices in one or two towns in the immediate neighbourhood. The prices, however, that had been given to his Chairman had been purely fictitious. They had been given to him by a coke buyer, who naturally wanted to buy coke cheaper than he was able to purchase it at the time. He (Mr. Carter) pulled a paper out of his pocket which contained the information which the gas managers in his district supplied to each other, and found that the price that had been mentioned to his Chairman was 3s. below what they were actually charging in the particular town named, and that, as a matter of fact, they had no surplus coke for sale. He placed this information before his Chairman; and his Chairman's appreciation of their little efforts rose very much indeed. That was another instance where the information they gave to each other came in extremely useful. However, he did not know whether this was a question that could be fully dealt with by the Association; he ventured to think it was not. If he rightly gauged the spirit in which the paper had been offered to the members, it was rather intended to be of an educational nature than indicating the full and final measures which could be taken, to place their commercial operations in the disposal of their residual products upon a permanent, and the best, footing. It seemed to him there were one or two initial facts they could all readily recognize. The production, for instance, of gas coke was not a vastly varying quantity. They knew to within a very few hundred tons what would be their make of gas coke in a year; and gas-works were almost the only producers of it. There were a few other works outside which placed coke on the market, but in quantity so small as to be practically negligible. Therefore, they could without much difficulty find out the country through how much coke was produced annually; and if they could deal with this production by some National Committee, under (say) the auspices of the Institution of Gas Engineers, then they could so regulate the market that the demand for coke should just come in those districts where, and at such times as, the best prices could be made. Of course, the large towns would throw in with the others; and if the outlets for coke and the sources of supply could be arranged to suit to the best advantage, then he ventured to say the returns they had been able to make from their coke sales would be largely increased.

Mr. H. Wimhurst (Sleaford) said their little combination in the northern part of the district had, to his mind, done a great deal of good during the last two winters. He could only express the hope that their methods might be tried by the members residing in the other portions of the Eastern Counties, and that in the near future, as Mr. Carter had suggested, the whole question would be taken up by the Institution of Gas Engineers.

Mr. J. Barton (Peterborough) also hoped that the paper would have the effect of bringing more members into their Commercial Committee, because he felt that they were overshadowed to some extent—not exactly by coke producers in their own immediate neighbourhood, but by two or three large works on the fringe of the district. These works sent large quantities of coke into places which the works within the district ought to supply; and, of course, this sort of thing brought down their prices very considerably. He thought the price of coke ought to be regulated to a great extent by the price of coal; the one ought to be regulated by the other. As they were paying a fairly high price for coal just now, he did not see why they should be compelled to practically give coke away as they were doing. Many were selling coke at shillings a ton below its actual value, owing, he believed, to this unnecessary competition. He trusted the paper would have the effect of bringing to the notice of these large producers the object they had in view.

Mr. J. H. Troughton (Newmarket) said he had been aware for some time that there had been a Committee of some description in the Eastern Counties to deal with the principal points raised in the paper; and he must confess that he had not been invited to join it. Otherwise, he should probably have done so. He happened to have a fairly good market for coke; but it had been spoilt for his Company by the means so well described by Mr. Shadbolt—that was to say, by outside competition, which had resolved itself into this, that part of the price obtained by competitors had gone to the Railway Company, and his own Company had suffered considerably through the loss of custom, and through having to bring their price down below what they might have obtained if others had not sent coke into their district. The Railway Companies appeared to be the people whose revenue most benefited from this. In the case anyway of the majority of the gas managers in the Eastern Counties, the Railway Company did not help them to dispose of their surplus coke, inasmuch as they would not even lend them waggons to convey coke, though he believed all outside gas-works could have waggons from their immediate Railway Companies, and utilize them for sending coke into the Eastern Counties. This would alone be an important matter for such a Committee as that suggested to take up. With regard to coke, he had a cutting from the "Daily Mail" of that day, which it would interest members to hear. It said: "Yesterday the steamer *Cairnault* (Hall Bros.) arrived at Cardiff with 2000 tons of German coke consigned to Messrs. Guest, Keen, and Co. This is believed to be the first of a series of cargoes to be shipped for consumption at the Dowlais Works. The total quantity already purchased is said to be 6000 tons." This was a large amount of coke to be imported from Germany; and if an Association such as theirs, or any other Association, could deal with competition of this character, it would be to the benefit of the whole gas industry.

Mr. C. G. Grimwood (Sudbury) said one difficulty which he recognized was that London was on the fringe of their district; and he knew that, in his own town, it was the price ruling in London that affected their coke sales. Even if they had a Committee similar to that which was suggested for the southern part of the Eastern Counties, it would be of little use, as London must always rule their price.

Mr. G. R. Casterton (Melton Mowbray) remarked that as one who had gained by the Commercial Committee, he could safely say that it had been the means of producing much more not only for the coke they had to sell at Melton Mowbray, but also for the tar and liquor. Those of the members who lived in the vicinity of larger towns felt that these towns, so to speak, kept the smaller ones from getting the price they ought to obtain. He was situated about 20 miles from Nottingham and Leicester; and they could not get either place into their Commercial Committee at present. It would be a great advantage if they could.

Mr. Shadbolt, in reply, said he was sorry to find that the influence of the surroundings was so overpowering that it practically prohibited a thorough discussion of a subject which, he thought they would allow him to say, was well worthy of it. However, he should like to see some practical result. He did not care a bit about the discussion if some practical action were taken; and with the permission of the President, he should, before closing his remarks, move a resolution. He was glad that Mr. Ogden had spoken, because he knew that that gentleman, next to Mr. Meunier—perhaps equally with Mr. Meunier—had a greater knowledge of the inner working of these Commercial Sections than perhaps anyone else; and though he had only given, very briefly, an outline of what had taken place in the Manchester Institution district, the members present might take it from him (Mr. Shadbolt) that he was more intimately acquainted with the details of the work than many people would imagine from what he had said. However, from his remarks it was clear that they would in the Eastern Counties be quite safe in moving on similar lines, because of the great success in this direction in and around Manchester and generally in the Lancashire and Yorkshire district. What discussion there had been had gone principally upon the question of coke. Of course, it was only natural that, in almost every case, the question of coke helped this matter forward; but he should like to point out that this was only one of the many subjects which had come under the purview of such Sections as already existed in Lancashire and Yorkshire. And in any of these subjects—embracing the whole of the commercial aspects of their industry—the benefit of these Commercial Sections might be found. There were many gentlemen who could not see that such a movement would be of any use to them, because they could not find there would be any immediate profit resulting with regard to coke, liquor, or something else. This did not affect the main question for the moment. The exigencies of the times in which they were labouring were such that, if they were to hold their own in the commercial world, if they were to discharge their duty to the public and to the people who had invested money in the gas industry, they must pay close attention to the commercial side of their business, not only individually, but collectively, for in this, as in everything else, "Union is Strength." Mr. Ogden had quoted cases of 4s. to 5s. per ton increase on coke having been obtained through the Commercial Sections; Mr. Carter had had cases nearly similar; and Mr. Wimhurst and Mr. Barton spoke in like strain. With reference to Mr. Troughton's remarks, it was a very sore point in the Eastern Counties, that the Railway Company would not lend them waggons for the conveyance of coke, but carried foreign waggons—coming from (say) Mr. Ogden's district—into the Eastern Counties, to compete with the producers on their own system. This was a thing the district gas companies were suffering from at the present time. Mr. Carter had indicated the direction in which possibly this work would eventually trend, when he said that this was a matter which could only be dealt with by a national body, such as the Institution of Gas Engineers. That might be so. His own experience of the national body was this, that they would move when compelled to do so. When the District Associations had shown, by acting as pioneers, that such and such a line of action was of benefit to the industry, the Institution would be glad to follow. The Association were a section of the Institution; and the members of the Council of that body were there to represent the industry which the members of the Association, in common with others, served. When the District Associations had fully taken up this question, and had proved by their action that it was beneficial, and that some general control was necessary between one district and another, then, and not until then, would the national body take it up. They would, therefore, be doing well for themselves and for the industry at large, if they asked the Committee of the Association to consider this question, and report to the members on some future occasion as to the line of action they thought best to follow. He begged to propose, to put the matter into concrete form—"That it be an instruction to the Committee of this Association that they thoroughly consider the question of Commercial Sections on the lines laid down in the paper, and report to the members on some future occasion."

Mr. Wimhurst seconded the motion, believing that great benefit would ensue from it.

The motion was carried unanimously.

Mr. W. D. CHILD (Romford) read a paper on—

GASHOLDERS AND TANKS—NOTES AND QUERIES.

In these days of prepayment meters, gas fires, cookers, improved lanterns, burners which really light the thoroughfares instead of serving to emphasize the darkness, exhibitions, canvassers, and the numberless modern methods which tend to a continuous increase in the consumption of gas, the time must come to every gas company when the engineer is driven to a consideration of the best methods of adding to the storage capacity of the works. This is not my own case, for I rejoice in having ample storage both for security and economy. But I have friends who, when taking a last look round, find the gasholders retired for the night (long before the engineer) into the depths of their tanks, leaving only a skeleton framing rearing itself into the darkness. Such conditions do not tend to produce that refreshing sleep which does so much to preserve health and prepare a man for the duties of another day. The manager of such a works may try to comfort himself, now that the period of stress is over; but he well knows that unless his Board can be induced to make provision for the coming winter, his difficulties will, by that time, have increased.

To any of our members who are contemplating work of the description alluded to, a discussion of ways and means may be advantageous. The type of tank to be built is usually dependent upon the character of the site and the class of building materials most easily obtained in the district. In the course of my business career, I have had a varied experience in tank construction—including brickwork with clay puddle backing, concrete with clay puddle backing (I first wrote concrete and puddle, but it cannot be made too clear that these materials must not be mixed, or you spoil both), brick in cement with cement sandwich (a type of building to be carefully watched), cast-iron tanks, complete, annular, and with clay puddle bottoms, and also steel tanks.

The first tank built in 1890 at the works under my charge was 81 ft. 6 in. diameter by 24 feet deep to the rest blocks, and was constructed with two 4½-inch rings of brickwork built in cement. When the circle was completed to a height of 2 feet, it was backed up with portland cement concrete; and when the latter was properly set, this again was backed up with clay puddle. The brickwork formed a true and neat lining to the tank, and saved the use of polling boards or other framing when putting in the concrete. This was a suitable type of tank for the site, as the excavation was made through 17 feet of sandy gravel, 2 feet of yellow clay, and 8 feet of London clay.

The only difficulty in connection with this tank was water, which was found at 4 feet from the surface of the ground, and through sand cracks in the London clay followed the excavators down to the foundations. Pumping was a necessity from the commencement of the tank to the completion of the gasholder, and added greatly to the cost of the work. The first difficulty was the disposal of the water as pumped. The site was not connected with any system of drainage, and the owner of the adjoining property refused to allow the water to be pumped into the water-course that runs through his land—hoping ultimately to obtain some payment for the accommodation. Fortunately, we had just completed a new 10-inch main which was intended to convey gas from the old works to the new gasholders when completed. This main crossed the river, and finding that there was not much difference in level between the two points, we disconnected the flanged steel pipe that crossed the stream, fitted a bend and standpipe about 6 feet high by the tank side, turned the pump delivery into this pipe, and sent the water to the river, upwards of half-a-mile distant.

The construction of the tank and gasholder occupied about ten months, and continuous pumping over so long a period exhausted the water from the gravel bed to such an extent that when we should have been glad of the water to fill the tank, we could not get it fast enough. We therefore shifted the pump to the river side, erected a standpipe at that end, and sent the water back through the 10-inch main and filled the tank in three days. In this way the gas-main became very useful before it was applied to its proper purpose. My neighbour thought that the pipe was laid to convey the water, and told me on several occasions that he would have allowed the water through his land for half what the pipe cost; and I never undeceived him.

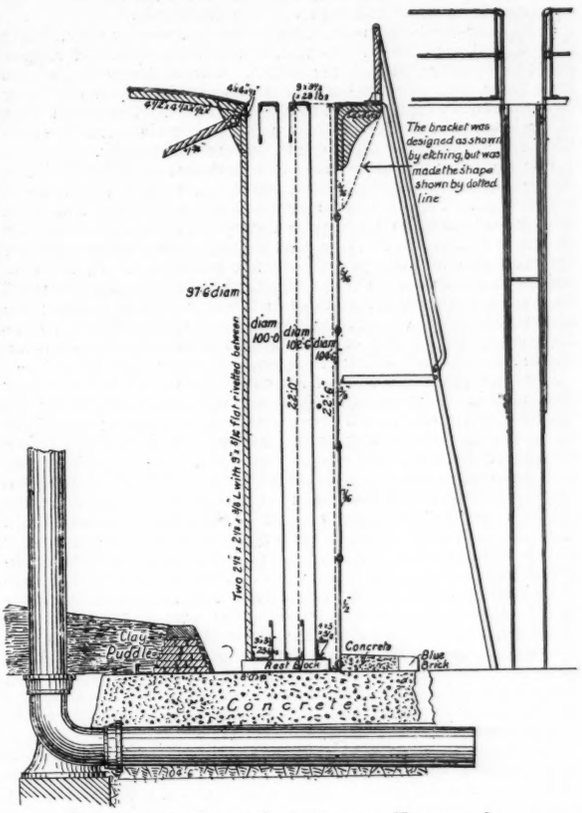
Water is sometimes very troublesome; but the engineer has the consolation of knowing that when his tank is completed and the water has again risen on the outside to its natural level, it will materially assist in reducing the strain upon the walls and in maintaining a tight tank.

My estimate for the tank just described was £1540; and it was built by a contractor of repute for £1550. The gasholder (single lift), with guide-framing, cost £1520; the whole working out at £25 11s. per 1000 cubic feet capacity.

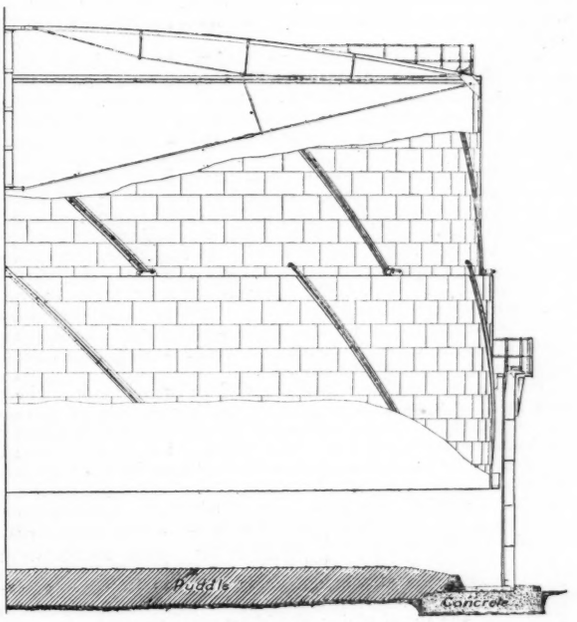
During the year 1900, I was again engaged in tank building upon the same site, and took out quantities and estimates for a concrete tank 104 ft. 6 in. diameter by 22 feet deep, and also for a wrought-steel tank of the same size. The concrete tank worked out at £2925, and the steel one at £2800, including about £700 for preparation of the site and foundations. As the concrete tank was intended to be sunk nearly to the surface level, and the steel tank to stand entirely above ground, many items would have to be eliminated before the structural value of the two tanks could be compared—viz., excavation, £482; timbering, £152; returning earth, £136; pumping, £300; retaining wall, £117; iron belts, £36—total, £1223; less value of 4000 yards of sand from the excavation at 2s. per cubic yard, £400—net, £823.

I may at once remark that all figures of cost are useful only for approximate comparison, as the cost of a tank of the same description will vary considerably in different localities, owing to questions of wages, value of materials, and cost of carriage.

As the difference in the cost of the tanks was not great, and the excavation for the concrete tank must have been made close to the foot of a high railway embankment, which would have thrown



DETAILS OF TANK, CONNECTIONS, HOLDER, &c.



TANK AND SPIRAL-GUIDED HOLDER.

a great strain upon the timbering on that side of the tank, and might have proved dangerous, it was decided to adopt the steel structure. Now, mild steel, unless well protected from exposure to the atmosphere, rapidly oxidizes and deteriorates; and, in my opinion, the bottom of a steel tank is particularly subject to this defect. The sides, with proper care at the time of erection and occasional attention afterwards, may be protected with paint or other coating; but the bottom once laid is done with. For this reason,

I determined to dispense with as many bottom plates as possible, and designed the tank in the way shown.

An annular foundation of concrete, 13 feet in width, was laid down to carry the tank side and a ring of bottom plates 8 feet in width. These bottom plates were of extra thickness, and acted as a stiffener to the sides; while the angle steel riveted to the inner edge kept the plates flat and close to the concrete foundation. To the outer edge of the plates was riveted the angle curb of steel, and to this was secured the vertical sides. I give no detail description of the tank, because, except the bottom, it was constructed as wrought-steel riveted tanks usually are.

Built upon the bottom plate, and close to its inner edge, was a ring of brickwork built in cement, five courses high, and capped with Staffordshire blue coping blocks. The wall was stepped on both faces, and was rendered in portland cement on the outer circumference and trowelled to a smooth face. The rough steps of the inner face formed a good joint for the clay puddle which filled the whole of the inner circle, 89 feet in diameter.

The work was not successful at the first time of filling the tank, as when about 8 feet in depth of water had been put in, leakage commenced. Then I at once had the water removed. I mention this circumstance to emphasize the opinion that, whatever the design of a tank may be, it is desirable that the responsibility for the execution of the work should not be divided. In the case under consideration, the Gas Company levelled the site, prepared the concrete foundation, and put in the clay puddle bottom; the contractors supplied and erected all the steel structure. To this division of labour and of control I attribute the trouble that occurred at the first filling of the tank.

Although the whole district abounds in clay, I was for a long time unable to make arrangements with any landowner for digging the material. The contractors were pushing their work forward with great energy, with the result that after the crown framing of the gasholder was in position and the platers waiting to commence the sheeting, the whole of the clay (upwards of 500 tons) was tumbled into the tank without being puddled. In the condition in which the clay was put into the tank, it was difficult, in such a restricted space, to properly work it into a plastic state; and the result was cracking of the puddle as soon as it was subjected to a heavy pressure of water. Careful examination convinced me that this was the only defect. I therefore had the whole of the clay removed from a space in the centre about 20 feet in diameter, and stacked it at the outer circumference; and the labourers then gradually turned the sides to the middle, at the same time carefully working and treading every foot of the clay. The re-puddling was perfectly successful; but the extra labour, and the water required to re-fill the tank, added about £70 to the cost of the work.

The whole result was so satisfactory that if again called upon to construct a tank above ground level, I should adopt the same system—viz., a stiff ring of bottom plates, steel sides, and a clay bottom retained in place by a brick wall. The brickwork makes a more secure job than a vertical steel plate, although the latter locks the joint in one direction. And in the case of a tank of large diameter, I should expect to obtain a serviceable tank at low cost.

Had the tank as described been fitted with a complete bottom of steel plates, the additional weight of metal would have been 50 tons, and the approximate cost £750. The cost of the bottom, as shown in the drawing, was £330, including the cost of re-puddling. The 507 yards of clay, puddled and laid complete in the tank, cost 11s. 6d. per cubic yard.

When building a gasholder in 1890, the Gadd and Mason spiral-guided gasholder had just been erected at Northwich; and I was so far attracted by the principle of construction that I entered into correspondence with the patentee, with a view to its adoption for the work that I had in hand. At that time, the guide-rails were fixed inside the tank and the guide-rollers to the bottom of the gasholder—both being inaccessible after the tank was filled with water. These two features presented difficulties in construction and risk in working too serious for me to undertake, especially as the holder to be erected would contain 70 per cent. of the storage capacity of the works.

Ten years of experience and the skill of experts in gasholder work had, by 1900, completely altered the construction of this type of gasholder, although the main principles of bottom guiding and spiral ascension and descension remained; and it was decided to put into the tank already described a three-lift spiral-guided gasholder to rise 102 feet above the ground level and having a capacity of 500,000 cubic feet. The construction of this type of gasholder is now familiar to most of you, but I may draw attention to the principal points of modification.

The guide-rails are now secured to the outside of each lift of the gasholder; the attachment being made to stout plates extending diagonally between the top and bottom curbs—the extra thickness of the spiral plates providing great strength where the strain of guidance is applied, and in combination with the vertical stays inside the holder afford great support to the side sheets. The guide-rollers for the top lift are fixed to the top of the dip of the middle lift. The rollers for the middle lift are fixed to the top of the dip of the outer lift; and the guides for the outer lift are on strong cast-iron bases bolted to the balcony plate of the tank. The whole guiding arrangements are therefore accessible whenever the several lifts are engaging or disengaging, and also for purposes of examination and lubrication.

The whole structure as now designed has ample margin of strength in the parts that receive the strain, and from the specially arranged movement of the holder, the strain appears to be more equally distributed over a number of points of support than is the case in a frame-guided gasholder, which, under the action of strong wind, may press very heavily upon a few standards, which then have to trust for support to the girders and bracing connected with the other standards.

Gasholder construction has been for many years in the hands of able men, with the result that splendid examples of guide-framing are to be seen. But well as the work may be designed and set out, there must be difficulty in the erection of standards upwards of 100 feet in height perfectly plumb and with all guide-channels parallel; and unless this condition exists, the guide rollers that may fit the framing when the holder is at rest are very likely to have some play as the holder ascends. And then the swaying motion begins, especially if the greatest care has not been exercised in adjusting the bottom rollers to the diameter of the tank. And this mention of bottom rollers reminds me that in the spiral type the number of guide carriages and rollers is greatly reduced; top and bottom sets not being required as in the case of frame-guided gasholders.

The necessity of the true fitting of bottom rollers is particularly noticeable when a frame-guided holder is first lifted, particularly if the depth of the holder is much less than one-fifth of the diameter. But with the spiral guide, the screwlike motion comes into play directly the holder is off the rest-blocks, and a truly level ascension is secured even with very shallow lifts.

On the completion of the gasholder it was filled with air for the purpose of testing the guiding arrangements, and to discover and stop any slight leakages. On the first occasion of lifting the holder, it was completely filled with 500,000 cubic feet of air in 2 hours 20 minutes; the air being driven into the holder by means of a steam turbine and fan, part of the plant used in the works for the manufacture of carburetted water gas. Finding the inflation of the holder such an easy process, it was filled and emptied at varying speeds, and, at times, was allowed to descend at the rate of nearly 4 feet per minute. Under all conditions, the action of the guides was perfectly smooth, and the operation of uncupping was shown on the pressure gauge by a regular diminution of pressure with but slight oscillation.

Since completion, the whole structure has been subjected to some violent gales of wind, during which I have stood on the balcony plate to observe the action of the guides, and have also watched the effect of wind pressure upon the pressure gauge in the governor room; and on grounds of steadiness of working and security I declare in favour of the spiral as against other methods of guiding.

The weight of guide-framing suitable for such a gasholder (three-lift) would be about 90 tons; and it would cost approximately £1800. The total cost of the tank and gasholder, 500,000 cubic feet capacity, works out at £14 per 1000 cubic feet, and compares very favourably with examples of frame-guided gasholders erected about the same period, of which I am able to quote a few instances.

No. 1.—Steel tank, 87 feet diameter by 23 feet deep, with two-lift holder, capacity 225,000 cubic feet, cost £28 per 1000.

No. 2.—Steel tank, 102 feet diameter by 25 feet deep, with two-lift holder, capacity 370,000 cubic feet, cost £21 per 1000.

No. 3.—Steel tank, 110 feet diameter by 26 feet deep, with three-lift holder, capacity 618,000 cubic feet, cost £18 10s. per 1000.

No. 4.—Masonry tank, 160 feet diameter by 35 feet deep, with three-lift holder, capacity 1,850,000 cubic feet, cost £16 15s. per 1000.

A spiral-guided gasholder to contain the same quantity of gas as No. 4 might be made with four-lifts instead of three lifts and the tank reduced in depth to 26 feet. The result would be a saving in tank cost of about £4600, and by dispensing with the framing nearly 300 tons of metal would be saved, and the total cost reduced to £11 10s. per 1000 cubic feet capacity.

On the question of security, a consideration of all points must, I think, again result in favour of the spiral guide. The necessity for great care in the design of guide-framing has been brought to notice by occasional serious accidents; and the best firms of gasholder builders have met this want by the excellence of their designs. But at best there appears to be an unnecessary expenditure of material and skill when the same result (security in action) may be obtained by the principle of bottom guiding.

The spiral-guided gasholder may be said to represent a large column with a base exceeding its height. In the case of a gasholder 120 feet diameter, with three 30-feet lifts, you have an example of a column the height of which is but three-fourths of its diameter, and with the base secured in position by the equivalent of 24 holding-down bolts placed at intervals outside its circumference.

The eminent builder of the largest gasholders has shown some desire to dispense with framing by sending the two top lifts "free" above the framing. So far as I know, these lifts have vertical ascension; and, if so, from my point of view, this constitutes a greater danger than sending the whole structure up "free" if fitted with spiral guides. The same authority, in a very interesting description of the development of gasholders and their gradual reduction in cost, mentioned that the cost had now been brought down to £5 per 1000 cubic feet capacity. It is, however,

only justice to the builders of gasholders the capacity of which is measured by thousands of cubic feet instead of millions, to mention that the lowest rate of cost can only be achieved when building holders of 10 million feet capacity and upwards.

The annual maintenance—that is, the painting of a lofty guide-framing—is a difficult and costly operation, and when the structure is of the lattice-work type is seldom performed in a satisfactory manner. At a time when such constant efforts are being made to reduce working expenses in gas-works, some attention may well be given to a subject bearing upon this point, as well as upon capital expenditure.

It would be an interesting occupation to design a tank and a spiral-guided gasholder of 15 to 20 million cubic feet capacity, especially if remuneration were given equal to a quarter of the amount that might be saved in competition with a frame-guided gasholder of equal stability.

Discussion.

Mr. E. J. Brockway (Cleethorpes) said the paper was particularly interesting to him, as he had just completed a 650,000 cubic feet holder on similar lines—that was, in regard to the principle of guiding. It was on the Gadd and Mason system. Respecting the dispensing with the ordinary steel tank bottom, that was a question which every engineer would have to consider on its merits when designing a gasholder and tank. In his own case, he believed, it would have been impracticable, although he should have liked to have carried it out on account of the economy. But in view of the character of the foundation he had to contend with—running sand in places, and a very bad bottom—it would not have been, at any rate in this instance, possible to have constructed a tank in the manner described with the certainty of it being a success and water-tight. As to the stability and soundness of the holder with this principle of guiding, his confidence would be shown when he said that, if he had now to put up a dozen holders, he should have no hesitation in adopting the Gadd and Mason system, instead of the old-fashioned one of columns and girders. There was no doubt in his mind, from the tests he had made with air during the last two or three weeks, that it was calculated to be firmer and more stable in a gale of wind than a holder, column guided, and supported vertically. As to the cost, in the case of a spiral-guided holder, it was 10 to 15 per cent. cheaper than the old style of structure; and the annual cost of painting and maintenance must be less than in the case of holders of the older form.

Mr. H. Wimhurst (Sleaford) observed that the Gadd and Mason holder which he had was much smaller than either Mr. Child's or Mr. Brockway's. It was a single-lift one, 115,000 cubic feet capacity, and was erected some ten years since. It had not caused him one moment's anxiety, and had worked splendidly from the day of its erection.

Mr. J. T. Jolliffe (Ipswich) remarked that, although the method Mr. Child had adopted in the construction of the bottom of the tank had proved successful, he did not think he should like to go in for it himself. He did not fancy the economy gained was such as to warrant a departure of this kind. There was not a great amount of metal in the bottom of a steel tank, nor did he think there was any fear of deterioration—that was, of course, when the tank was sunk about a foot beneath the surface of the ground. He was not at all in love with spiral-guided holders. In his opinion, they were hideous things; and in his case at all events, there was no economy to be got by adopting the principle. As most of the members were aware, they erected a new holder at Ipswich some five or six years ago (perhaps a little more). In drawing out the designs and asking for estimates, he invited the patentees of different systems to quote for their own special class of gasholders; and, in all cases, the non-guided holders were the dearest. Mr. Child seemed to have been more fortunate. The total cost of the three-lift gasholder and steel tank erected at Ipswich, which was of a capacity of a million cubic feet, worked out to £10 per 1000 cubic feet.

Mr. J. Davis (Gravesend) could not say he was very sweet on spiral-guided holders; and he agreed with Mr. Jolliffe that they were hideous things. He put up a gasholder some six years ago, with steel framing, and of 550,000 cubic feet capacity, which worked out at a little under £16 per 1000 cubic feet. It had a cast-iron annular tank, of 120 feet diameter.

Mr. J. H. Troughton (Newmarket) said that in small towns they were not often called upon to build gasholders. But he did remember one which was erected some eighteen or twenty years ago; and he always believed this was an example of cheapness. It was designed by Mr. George Anderson, who, at that time, was in a very large way of business. The tank was constructed of concrete exclusively. The walls he thought were about 2 ft. 3 in. at the bottom, tapering to 15 inches at the top. The holder was 100,000 cubic feet capacity; the diameter, 64 or 65 feet; the depth, 18 ft. 6 in. The concrete part of the tank cost £560. This was a very low figure indeed for a tank. In the tank was fixed a telescopic holder of two lifts; and the contract for the holder was £1000. Consequently the tank and holder together cost about £15 10s. per 1000 cubic feet. For a holder of this description, with cast-iron columns, it worked out very reasonably. The tank had remained perfectly water-tight; and there had never been the slightest trouble with it. It certainly looked a good deal better than the spiral-guided holders he had seen. While he did not like the appearance of them, at the same time, if they could be erected cheaper than the one he had spoken of, he did not know that he should not go in for one if he wanted it.

Mr. J. Barton (Peterborough) thought the author of the paper deserved some congratulation for his very original idea in gasholder tank construction. He should like to know, if Mr. Child could tell them where the tank leaked—whether he found the leakage between the masonry and the bottom plates. It seemed to him that this was—having there masonry and iron or steel—the weakest point in the bottom of the tank. Or was it that the puddle was altogether indifferent?

Mr. Child, summing up the discussion, said there were few criticisms to reply to. Mr. Brockway had made a remark to the effect that the type of tank he (Mr. Child) had described would not be suitable in his case. That was probable. Every engineer must determine for himself, by the ground he had to deal with, whether it was suitable for carrying a particular type of construction; and having nothing trustworthy in the nature of ground that Mr. Brockway thought would carry clay puddle with high-pressure water upon it, he would not be justified in adopting any such course as that mentioned in the paper. Mr. Jolliffe held the opinion that there was no danger of deterioration in the metal bottoms of tanks when laid. He (Mr. Child) must say that his opinion ran to the other extreme. The inside of the tank was preserved by the presence of water. But there was nothing to prevent air, damp, and moisture getting in contact with the underside; and if this took place, then he felt sure some oxidation must be going on. Another point was, when discussing the question of tank building with some tank constructors of good repute, they appeared to him to be inclined to put metal so extremely light into the bottom of the tank, that he was utterly astounded. They put plenty of metal into the sides, where unsupported, to resist the strain of water pressure; but they relied upon the supporting action of the earth under the bottom to such an extent that they reduced the metal, in that case, to what he considered would be a very dangerous substance, and such as would require only a few years to oxidize and altogether destroy. If a bottom was put in to what he considered was a safe limit, then the weight of metal was, if possible, worth saving. In a tank 104 feet diameter, the saving would be 50 tons, and nearly 70 tons if proper metal was used; and they could not put in metal at less than £15 a ton. In the guide-framing, again, they could save about 300 tons; so that there must be an appreciable money saving there. Why Mr. Jolliffe should have been unfortunate enough to get a price higher for a spiral-guided holder than for one with ordinary framing and guiding, he could not possibly understand. If gasholder constructors, having got hold of a good idea, spoilt their market by asking more for their work than they ought to obtain, they must be left out in the cold. Mr. Troughton gave some interesting particulars of a holder. Mr. Anderson always had the reputation for good work. His work, as a rule, was very light in construction, and was always carried out at very low cost. Mr. Barton asked where the leakage occurred. It was entirely the fault of the puddle. It was badly made in the first instance, so that, when the pressure of water came upon it, it actually broke in several places; the cracks (which were something like ¾ inch wide) radiating from the centre to the sides. It was not a parting of the clay from the tank wall. On examination, he saw the fault was bad, but was easily rectified. Everything else having been cleared out of the tank, the clay was subjected to a thorough soaking, so that every foot of it could be dealt with. It was then worked into proper plastic clay puddle, and a good job was made of the work.

Mr. Troughton proposed a vote of thanks to the readers of the papers. The one by Mr. Shadbolt gave them a good deal of food for reflection; and if the result was the formation of Commercial Sections such as he suggested, it would be a benefit to the industry generally. Mr. Child's paper was also interesting; and it was good of him to write it at short notice.

Mr. Ruggles, in seconding, said he did so with much pleasure, because Mr. Shadbolt was good enough to mention in his paper their small works at Leighton Buzzard; and Mr. Child came forward at the last moment, at his (Mr. Ruggles') request, and gave them his instructive paper.

The motion was heartily adopted.

Election of Office-Bearers.

The President proposed that Mr. Shadbolt be elected President of the Association for the ensuing year. It was a great pleasure to him to propose Mr. Shadbolt's name, because he knew he would make a worthy President.

Mr. Child seconded the motion with a great deal of pleasure. Mr. Shadbolt had done admirable work for the Association at all times. If elected President, he was sure their friend would endeavour to carry out the proposition he had put to the meeting that day, so that the subject would be thoroughly brought home and every possible use made of it.

The motion was cordially agreed to.

Mr. Shadbolt thanked the members very heartily for the high honour they had conferred upon him. He trusted their confidence had not been misplaced, and that they would give him their best support. He, on his own part, would use his very best endeavours for the Association.

Mr. Barton proposed Mr. Brockway, of Cleethorpes, for the vice-presidency. Mr. Brockway's energy and great ability on all

matters relating to their work eminently fitted him to preside over the Association.

Mr. C. G. GRIMWOOD (Sudbury) seconded the motion, which was also heartily passed.

Moved by the PRESIDENT, and seconded by Mr. SHADBOLT, Mr. Guyatt was re-elected Hon. Secretary and Treasurer.

The Auditors (Messrs. C. Panchen and J. Witten) were re-appointed, on the motion of Mr. CASTERTON, seconded by Mr. WIMHURST.

Proposed by Mr. CHILD, and seconded by Mr. F. PATERNOSTER (Felixstowe), Messrs. J. Carter, C. F. Ruggles, and J. Davis were elected to the Committee—the last-named gentleman for one year in place of Mr. Brockway, on his elevation to the Vice-Presidency.

PLACE OF AUTUMN MEETING.

Mr. SHADBOLT said, the members having elected him to the presidency, in the ordinary course, the meeting should be held at Grantham in September. But there were excellent reasons why the next meeting should be at Cleethorpes instead of at Grantham; and then, if the fates were propitious, he might be able to have the Association at Grantham when Mr. Brockway was in the chair, and the welcome would be most hearty. He therefore proposed that the next meeting be at Cleethorpes.

Mr. BROCKWAY, in seconding, said, if the members adopted the motion, both his Directors and himself would cordially welcome them. They would do all they could to make the visit one of pleasure and profit.

VOTES OF THANKS.

Proposed by Mr. CARTER, and seconded by Mr. F. LENNARD, the services of the officials, one and all, during the past year, were recognized in an enthusiastic manner.

Mr. SHADBOLT proposed a vote of thanks to Mr. Leopold de Rothschild for his great kindness in allowing the members to inspect his magnificent grounds, for the accommodation he had so graciously provided, and for the refreshments of which they were about to partake.

Mr. CHILD, in seconding, said this was the second time that Mr. Rothschild had permitted District Gas Associations to visit his grounds; and they were under a debt of gratitude to him for allowing them to meet there in such comfort and amid such splendid surroundings.

Tea was then served; and immediately afterwards the members drove, by the conveyances which had brought them from the gas-works, to the Swan Hotel, where in the evening they dined together. All the local gentlemen who had assisted in the day's doings, together with other friends, were present. A musical programme of exceptional merit was provided by Mr. Ruggles and his Directors—being contributed to for the most part by local talent. The speeches accompanying the toasts were also good in matter and delivery. Thorough enjoyment made the evening pass quickly.

The Sale of Coke by Weight.

A Bill to amend the Weights and Measures Act, 1889, in respect of the sale of coke by weight, has been introduced by Mr. Rose, the Member for Newmarket. It provides that "upon the sale of coke by weight, the provisions of sections 21 to 31 inclusive of the Weights and Measures Act, 1889, are to apply to such sale, and to all the proceedings relating thereto, in like manner as if these sections were re-enacted, with the substitution of the word 'coke' for the word 'coal' throughout; and the powers and duties of the local authority and of its officers, and of any other authority, are to be extended accordingly. Nothing in the proposed Act is to make it obligatory on any person to sell coke by weight or in any other manner."

Wood Stave Pipe-Line in Pennsylvania.

Wood stave water-pipes seem to be steadily growing in favour in the Eastern States, where it was generally held at one time that their use in the West was mainly due to the high cost of iron and steel mains when in place in that part of the country. It is now known that wood pipe may be economical, even in the heart of the Pennsylvania iron district. According to "Engineering Record," at Johnstown a 6½-mile main from 36 to 44 inches in diameter proved a successful solution of a troublesome problem, which Mr. J. Birkinbine was recently describing at the Engineers' Club, of Philadelphia. The conduit had to be laid along the Little Conemaugh River, where there is no waggon road at most places; the creek and the Pennsylvania Railway occupying the limited space between the steep hillsides. To handle cast-iron pipes weighing from 3 to 4 tons apiece, and joint them in such a locality, would have been costly. Riveted steel pipe did not seem desirable, in view of the light head and the occasional acidity of the water, which is used neither for domestic nor boiler purposes. Wood-stave pipes proved most economical. They were made of Washington fir staves from 1½ to 1⅝ inches thick, and banded with ⅓-inch round rods,

WAVERLEY ASSOCIATION OF GAS MANAGERS.

Half-Yearly Meeting at North Berwick.

The Waverley Association of Gas Managers held their Eighty-Eighth Half-Yearly Meeting at the Royal Hotel, North Berwick, last Thursday—Mr. J. GEMMELL (Melrose), the President, in the chair. There was a company of over fifty present.

Bailie SIM, the Convener of the Gas Committee of the Corporation, in the absence of Provost Macintyre, extended to the Association a welcome to the Royal Burgh. He said the members would find some of its streets very picturesque, but probably this would not attract their attention, because their interest would be centred in the manufacture of gas, and a visit to the new works would be of more importance to them. The burgh had both the advantage and the disadvantage of being an expanding one. The advantages they found in an increasing revenue, and the disadvantages in the new schemes they had had to undertake. Within the last few years, they had expended something like £70,000 upon the water supply, a new hospital, a new slaughter-house, and other works. Last, but not least, about eleven years ago, they took over the gas supply. He was not a councillor at that time, but one of them asked him his opinion on the subject. He based it upon the experiences of various other burghs which had taken over the gas-works, and he said he thought they would be better without them. This had, however, proved to be an erroneous view, because under the Town Council the people had, from the first, consumed gas at a much cheaper rate, and they had also been able to remove the eyesore of the old works. They were not only an eyesore but a nuisance, because there were many people, he believed, who did not care for the perfumes that came from gas in its manufacture. So that the works really were a hindrance to the popularity of the place. Now they had fine new gas-works, which they had erected at a cost of something like £16,000; and notwithstanding this expenditure, they had been able to keep the price of gas at 3s. 9d. per 1000 cubic feet, which to his mind was not bad, considering the outlays they had had. When they took over the gas-works, they employed Mr. M'Gilchrist as Arbiter, and they had applied to him in all cases in which assistance had been needed ever since; and they had found that his guidance had really been very useful to them. Mr. M'Gilchrist had made the new works one of the finest of their size in the United Kingdom. However, the members were practical men, and would judge of this for themselves.

The PRESIDENT conveyed the thanks of the meeting to Bailie Sim for his very kind welcome.

Mr. H. RUTHERFORD (Aberlady) moved, and Mr. P. BLAIR (Haddington) seconded, that Mr. J. Tulloch (Loanhead) be appointed President for the year. This was agreed to.

Mr. TULLOCH having returned thanks for his appointment,

Mr. W. YOUNG (Penicuik) was re-elected Hon. Secretary, and returned thanks.

THE PRESIDENTIAL ADDRESS.

The PRESIDENT then delivered his address as follows:—

On behalf of the Waverley Association of Gas Managers, I beg to offer you a very hearty welcome to this, the eighty-eighth half-yearly meeting. I am glad to say that, looking at our industry as a whole, and the continued demand for gas for the purposes of lighting, heating, and power, progress has been everywhere fully maintained. When we take into consideration the very depressed state which trade has been in for some time back, and the consequent economies practised on the part of consumers, I think we have every cause to congratulate ourselves on having come so well through this period of depression.

As our time is very limited, I do not propose to weary you with a long address, but will content myself with merely describing to you what we have done in Melrose to combat the competition of the Electric Supply Company. The electric light there is now a competitor of some sixteen months' standing. Early in 1901, the Company, with the support of the Town Council, secured a Provisional Order for the supply of electric light in the burgh. It was not, however, until the summer of 1903 that a start was made with the work in connection with the installation; and it was in the following year—Jan. 11, 1904—that the light was turned on in the town, and became a competitor of the gas in actual fact. The Council, by their agreement with the Company, are bound, wherever the cables are laid, to use electricity in the public lamps. The original agreement was that the lamps should be of 16-candle power. It was found, however, by experiment, that this type of lamp was not equal in light-giving power to the ordinary flat-flame burners in use in the street-lamps. This type of lamp was then discarded by the Company, and they fitted up instead some 75-candle Nernst lamps, at a cost per annum of £1 2s. 10d. per lamp, 700 hours' burning.

Previous to the introduction of electric lighting, my Company several times offered the Town Council to fit up the lamps with No. 4 Kern burners; but their offer did not meet with acceptance. I was determined, however, that my Company should have a look-in for the street lighting. Realizing that every lamp fitted with incandescent burners was a standing advertisement in favour of gas as an illuminant for street lighting, which has been proved by its general adoption all over the country for this purpose. As against the electric light, I offered to fit up and maintain a dozen

incandescent lamps free. This offer being again rejected, I secured a stance near our works, and fitted up a No. 4 Kern burner in an up-to-date lantern; this being the only outside incandescent lamp then in Melrose. The results obtained from it have been most satisfactory. Many inquiries have been made and installations fitted up through consumers seeing this lamp. The annual cost of the lamp, burning the same number of hours as the electric lamp—viz., 700 hours—is 11s. per annum; being 11s. 10d. less than the Nernst lamp, with a lighting value for the incandescent lamp of 25 per cent. more.

It may be said that though the electric light has now got over the teething and vaccination processes, it cannot yet be said to be a particularly healthy child, at least in so far as Melrose is concerned. Since its introduction some twenty consumers have partly fitted up their houses or business premises, mostly on the free-wiring system. To meet the competition, my Company periodically circularize the district with plain facts as to the relative costs, and push the incandescent burner for all it is worth. Wherever I can, and especially next door to or opposite premises fitted up with the electric light, I install incandescent lamps, as it is only right that the two lights should be seen together, so that a fair comparison can be made by consumers. I am pleased to say that the comparison is not unfavourable to gas. Last winter I fitted up a 400-candle power intensified lamp next door to a shop using electric light, which shop has six 16-candle electric lamps, consuming in money value 3d. per hour, while the 400-candle incandescent lamp uses only ½d. worth of gas per hour. Even to the most prejudiced there is no comparison of their respective lighting effects. Not only have these incandescent burners the effect of stopping the onslaughts of the competing illuminant, but their brilliance attracts the attention of the public, and leads them to make inquiries; and in this manner the various methods of gas lighting are brought more under the notice of consumers.

Since the introduction of electric light, the impetus given to incandescent lighting has been abnormal—nearly every consumer has gone in for this system; and it has also been introduced into churches. The type of burner used in churches is the No. 4 Kern with "Holophane" globes. Just recently my Company were in competition for the lighting of one of the churches. The Gas Company offered to put in No. 4 Kerns with "Holophane" globes at a cost of rather less than 10s. per burner, with a lighting value of 100-candle power per burner; there being 17 burners in all, with a total light value of 1700-candle power, at a cost for the lot of £8 10s. The Electric Supply Company offered to fit up thirty-two 16-candle power lamps, with a total light value of 512-candle power, at a cost of £50. Needless to say, the gas had it. I may mention that the annual cost of lighting the church with gas was £1; while if electricity had gained the day, the annual bill would have been about £7.

Gas-stoves, gas-fires, and all heating apparatus, receive our greatest attention, and are vigorously pushed. My Company supply these at simple hire rates, and they become the consumers' own property in five or ten years, according to arrangement. Unfortunately, the Gas Company cannot afford to permanently keep a trained fitter to look after the wants of our consumers. I devote a good part of my time, when on my quarterly survey, to the consumers' wants, and educate them, to the best of my ability, in the cleaning of incandescent burners, the putting on of mantles, &c., at the same time not forgetting to point out the lower costs as compared with our rival. It is surprising how soon consumers become adepts in these things; and not only are they pleased at their own abilities, but to those of them with whom I have not come in personal contact the others are only too pleased to lend a hand. In this way does the gas keep its rival at bay; and I find that an hour or two spent with the consumers in educating them well repays me.

In conclusion, gentlemen, I have to say that the introduction of electric lighting in Melrose has in no way hurt our output. On the contrary, it has stimulated business, and caused my Company to display greater energy in creating and fostering new custom. Electric competition in itself we need not fear. It is only when it is bolstered up by the public rates that it enters into serious competition with us.

Discussion.

Mr. H. O'Connor (Edinburgh) said he thought the address was one which called for discussion by gas managers who were interested more particularly in pushing their business in the towns they were serving, rather than by those engaged on the technical side, which was the one he might more readily touch upon. But it was always interesting to hear of any methods of successfully combating what he might call their friend the electric light, because he considered that wherever this light had been put in, gas had not suffered in the least in regard to the quantity consumed. If one shopkeeper had his place lighted up well with it, it was necessary that his next-door neighbour should have his shop illuminated equally brightly, even if not more so; and he then applied to both the electric light and the gas people so as to ascertain what would be the cost of obtaining the light he wanted. He then probably took the cheaper, which certainly, at present, would prove to be the gas method of lighting. Consequently, he would burn as much gas as had previously been burned by himself and his next-door neighbour together—and perhaps a little more; and this would give an extension to the gas supply. The President spoke of only 700 hours' burning per annum. This worked out at an average of about two hours per night; but he presumed that the lights would not be used on moonlight nights. Then he noticed that he used Kern burners. This would be a rather expensive form of lighting for private houses, and it might be as well if he were to try to push the sale of other burners. A point the President did not refer to was that of fitting up free stoves and lighting in houses, in the same way as he mentioned the electric light people did. If this were done, in connection with the prepayment meter, he could, by charging a slightly increased price, get a return for the expenditure on fitting up the stoves or other apparatus he might put in. In the South this had been very successfully done; in fact, nearly all prepayment meters were fitted up with free piping, so that it took the place of the free wiring which was done by electric light companies.

Mr. A. C. Young (Arbroath) said his feeling was that they had no need at all to fear the electric light, when they heard of the experience in Melrose. What he could not understand was how the electric light people obtained a footing at all in Melrose. One thing would undoubtedly be a source of revenue to them; and that was the street lighting. There was no doubt, he thought, that no electric light company would enter a small town till they got the street lighting. In Arbroath, a Provisional Order for the introduction of electric lighting was obtained. The Corporation tried to treat with various companies for its introduction, and, as long as there was a prospect of their getting the street lighting, the companies were willing to negotiate; but when this was off, they would not take up the Order, and the result was that it remained in abeyance. In Montrose, the Electric Lighting Company had laid down very much the same conditions as had been done in Melrose. They had the Corporation bound down to light each street with incandescent electric lamps as the cable was laid. This had been found to be a very great hardship, and the Corporation would now be glad to get out of the bargain. In Kelso, the Gas Company undertook to keep up the street lighting for a given sum per annum. The Company might take out a flat-flame burner, and put up an incandescent lamp, and it cost the Corporation nothing more; but the result was that now, he supposed, 80 per cent. of the street-lamps were No. 4 Kerns—and they would never have the electric light in Kelso.

Mr. D. Vass (Airdrie) said in his town gas was supplied by a Company at the time of the introduction of the electric light, and the Corporation gave every support to the Electric Company to introduce their light as a competitor. Now the Corporation had taken over the gas supply, and they were sorry for their former action, because they found themselves under conditions which required them to work the electric light for a long course of years. He thought this should be a warning to corporations who had not yet got electric lighting, because they might come to own the gas-works later on; and in introducing electric lighting they might perhaps be making a millstone for their own necks. The Nernst lamp was being pushed in their town as against high-power gas lighting. To compare the Nernst lamp—which they might say was at the top of the tree in electric lighting—with the ordinary Kern was scarcely giving the latter a fair chance. It should be compared with high-power lights; but even with the Kern they found that the Nernst was twice the cost, in almost any situation in which they might find it. He had lately fitted up a church, very much on the same lines as the President, with Kern lights; but there was a difficulty in beginning to light up churches or work-shops, because the jealousy of the trade came in, which was an important matter in some cases. They must be very careful, if they were under a corporation, not to touch the trader, because he could get hold of a town councillor, who "rounded" on the gas manager. But they were now going on definite lines, allowing discounts for work done by the Corporation—that was to say, they kept as near as possible to trade prices. When a consumer came to them and asked what was the best thing to do, they were in a position to say what they considered best, and to undertake the work, which was better than sending a gas-fitter, because he might be interested in electric lighting and advise it instead of gas. An Electric Company had been about two years in Airdrie, and in that time they had only managed to secure about forty consumers. They had, unfortunately, secured the best lighting district of the town, through the assistance of the Corporation. He strongly recommended prepayment meters to anyone wishing to increase his business, and give them and slot cookers free.

Mr. Forbes Waddell (Queensferry) was glad to hear that the President was able to hold his own in Melrose with the electric light, although he was not greatly surprised. Town councils, it seemed to him, were very ready to make a grab at an electric installation. It was all very well to say that they would get a light from an arc or a Nernst lamp about as cheap as from a decent-priced gas; but the arc lamp was not very convenient, except for lighting large areas, and the Nernst lamp very often got out of order. The arc lamp was, however, as cheap as gas when they came up to 5s. or 6s. per 1000 cubic feet. In the town, for instance, which he was supplying with gas, there was talk of having electric lighting. A Company were purposing to put in eight lamps free to each house; but so long as there were incandescent gas-lamps he was not afraid, although the gas was 6s. 3d. per 1000 cubic feet, because incandescent electric lighting was practically four times the price of gas. In small towns there was really no scope for electric lighting; it was in the big ones where it was taken in, because it was a luxury, and because it was cheap. Gas cookers should be pushed as much as possible. He did not think there was any gas manager who held otherwise. He had

had the courage to take a shop for showing cookers and cooking utensils in a town the population of which was about 2000. He thought it would pay if coupled with the selling of mantles.

Mr. J. M'GILCHRIST (Dumbarton) said that at the last meeting of the Association the President treated them to the work, properly considered, inside of a gas-works, and that day he had devoted his attention to matters outside, which were sometimes equally as important as anything to be found inside. If it was difficult for a small company to exist, having paraffin oil for a competitor, it would be even more so for the Electric Supply Company in Melrose to live when the Gas Company was managed by so able a man as Mr. Gemmell. He only hoped that the money of the widow and the fatherless was not invested in the Electric Light Company. This reminded him of the evidence he gave on the Stirling Gas Transfer Bill. He there tried to show the Lords that in Glasgow, Edinburgh, Dundee, Aberdeen, Coatbridge, and Ayr, during the time there was opposition from electricity, the ratio of increase in the gas consumption had been much greater than at any previous time; and he thought that the reason he then gave was very much that which Mr. O'Connor had given—viz., that of competition in lighting. The President had omitted to say whether his Company had suffered in their dividend through the competition; and he certainly did not tell them that their consumption had fallen off in any way.

The PRESIDENT thanked the meeting for the kind way in which they had discussed his address. In answer to Mr. M'Gilchrist, he might say their dividend had not been reduced through the Electric Supply Company's competition. The consumption, if they excepted the case of the District Asylum, in which they had fitted up an electric light installation for themselves, had rather gone up. The lamps in Melrose were based upon about twenty nights per month, for eight months in the year. As to Kern burners, he found that with the high quality of gas they supplied in Melrose, the "C" burners were very liable to give off a carbon deposit, and that with the Kern burner it was very seldom that this deposit was found. He always advised the use of them, even although the cost was a little more. In explanation of the time the Electric Supply Company took to get to work, he might say that they were in negotiation with the District Asylum, trying to get the lighting of it; but they did not succeed, and at last were obliged to go on without it.

Mr. P. BELL presented Mr. Gemmell with the President's medal of the Association.

The PRESIDENT having expressed his thanks for the gift, the proceedings terminated.

The company drove, in conveyances provided by the Corporation of North Berwick, to the new gas-works (as described in the "JOURNAL" for Oct. 18, 1904), which they spent an hour in examining with much interest; the simplicity of the works and their manifest efficiency being matter of common comment. The Manager (Mr. J. Black) had everything in order for the visit; and he was freely congratulated upon the excellent appearance of things generally.

Returning to the Royal Hotel, the party dined together, under the presidency of Mr. Tulloch. Mr. M'Gilchrist proposed the toast of the "Waverley Association of Gas Managers." In doing so, he said he was asking them to drink to the first Association of Gas Managers that ever was known in the world. The President acknowledged the toast. North Berwick being awkwardly situated for most of the visitors, many of them left for their homes by a train early in the afternoon.

Manchester District Institution of Gas Engineers.—We learn from the Hon. Secretary (Mr. H. Kendrick, of Stretford) that the next general meeting of the Institution will be held on Saturday, the 13th prox., at Leeds. The programme will include a visit to the New Wortley Gas-Works of the Leeds Corporation in the morning, and, at the business meeting, a paper by Mr. J. C. Belton, of Chester, a discussion on Mr. Meunier's Presidential Address, the "Question-Box" proposal, and a suggested alteration of the rules to permit the admission of associate members.

The "F. P." Air-Light System.—From America, supported by numerous testimonials, comes the "F. P." Air-Light System; and an office has been taken in Victoria Street, Westminster, for cultivating a knowledge which it is hoped will eventuate in profitable business. The name—"The Air-Light"—is a significant one; and almost tells the reader all he will want to know. It is another variation of the many ways of doing an old thing. One of the air-lights is said to be equal to 35 ordinary open gas-jets, or 31 incandescent 16-candle power electric lights, or 6 Welsbach burners with coal gas, or 17 30-candle power acetylene lights; and three of the air-lights are equal to two 1200-candle power arc lamps. The entire cost of producing and maintaining air light of 1000-candle power is stated at about 1d. per hour. A comparison of cost claims the following figures: 310 16-candle power electric lights cost 3s. 3d. per hour, 310 ordinary gas-lights, each of 16-candle power, cost 3s. per hour, and 10 air-light burners (above 5000-candle power) cost 6d. per hour. It is observed here that comparison is not made with the price of ordinary and high-pressure incandescent gas-lights, the omission of which comparison causes us to remark that the "F. P." Air Light, where coal gas can be obtained at a fair price, will have some difficulty in this country in establishing itself.

LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.

Boosting and its Application to the Distribution of Gas.

The fare provided for the members of the Association at their April Meeting—which was held on Friday at the Regent Street Polytechnic, under the presidency of Mr. Walter Grafton—consisted of a contribution by Mr. W. E. Dean, of Tottenham, on "Boosting and its Application to the Distribution of Gas."

Mr. Dean prefaced his paper by a remark on the importance to gas engineers of securing the best and cheapest methods of distribution, and the need for those in charge of distribution departments seeing that consumers are satisfied, not only with their light, but with the quantity of gas supplied to them for cooking and other purposes. Complaints, he said, were frequently heard regarding the quality of gas; but it was not always a candle or two of illuminating power that was wanting. Sometimes a few additional tenths of pressure would give the desired effect. It was quite a mistake to suppose that the same small service-pipes which were sufficient for a district when only a few houses were scattered over it, would be adequate when the builder came along and put up whole streets of dwellings; it would merely result in discontent on the part of the consumers. Very often one could not find much fault with the size of the main that was supplying a certain part of the district; but a slightly higher pressure in it—especially where the incandescent burner was largely used—would tend to help matters and bring about a harmonious feeling between the consumer and supplier. That the lack of pressure went from bad to worse was obvious, as everybody was striving to get as much of the gas as possible; and, of course, the greater the demand the less there was for each consumer. If in such cases observations were made when the maximum load was on, and a few diagrammatic records secured showing the state of the pressure at the same time, steps would soon be taken to remedy this evil, with a resulting increase in consumption which would adequately repay all trouble. In some text-books it had been stated that one of the most important duties of a gas manager was to keep down the pressure in the mains; but this was contrary to the general practice, while it was essential to keep down excessive pressure, which would do more harm than good by increasing the quantity of unaccounted-for gas. The open lead joint that was in general use about the country had a good deal to do with the doubt that existed as to whether this was a suitable method of jointing mains which were ever subjected to a pressure above the normal; but if these joints were well made and caulked, there should be no fear of them leaking to any extent. For high-pressure mains, however—5 to 25 lbs. per square inch—screwed or other special joints were undoubtedly the best to use.

The author next proceeded to give some explanation of the system of boosting that is at present in use at the Tottenham Gas-Works—reference to which was made in the "JOURNAL" at the time of the Association's visit there at the end of 1903 (see Vol. LXXXIV., p. 604). He said that in the latter part of 1902 it became apparent that, to keep pace with the demand for gas all over the somewhat scattered and rapidly increasing district—and particularly the portions farthest from the works—it would be necessary to increase the initial pressure so that each consumer might have sufficient gas to meet his requirements. With the aid of the holders alone, it was only possible to maintain the pressure while they were fully cupped—namely, during the time the bottom lifts were available for use; and this meant being full up when the heaviest draught was on, which was a very difficult condition of things to control with a large output. The boosting plant—consisting of a Sturtevant No. 7 size fan and a steam turbine mounted on a common bed—was therefore installed. The fan was similar to those used in connection with carburetted water-gas plants, but had one of its side inlets closed, and the opposite one connected to the main from the holders. The discharge from it was in a downward direction, instead of horizontal; this being the most suitable for the position. The turbine was a 10-horse power one, of the De Laval type; and the motion was transmitted to the fan shaft by means of a system of helical gearing in the ratio of 1 to 10. When the turbine wheel was running at top speed—23,000 revolutions a minute—the gearing reduced it to 2300 revolutions on the fan shaft. It was essential for the fan to run at this speed to maintain an outlet pressure of 13 inches, with the help of an inlet pressure equal to 7 inches; and it was found that the fan was capable of dealing with somewhere about 420,000 cubic feet per hour at the time of heaviest demand—between 8 and 9.30 in the evening.

Mr. Dean explained that the gas, on leaving the fan, flowed along a 36-inch main to the inlets of three station governors, the sizes of which were 30 inch, 24 inch, and 18 inch respectively. The pressures maintained on the outlets were 6½ inches in the case of the first two, and 10 inches in that of the third. After acting as feeders to smaller mains, the three mains through which the gas passed after leaving the 36-inch main were connected together, producing an equable distribution over the whole of the district. The author said the value of boosting, or increasing the initial pressure, could readily be seen when distributing gas over a district like Tottenham; and he concluded by referring those members interested in the steam-turbine to the paper read by Mr. W. D. Child before the Gas Institute in 1902.

Discussion having been invited, Mr. Carpenter asked Mr. Dean if he used means to reduce the pressure at the point of consumption—that was in the area to which he was sending the high-pressure gas. Mr. Scarth inquired what pressure was attained at the end of the feeding mains, and whether any other means than turbines had been employed for driving boosting fans. Mr. Carpenter remarked that in his district there was a somewhat similar arrangement in operation to that described by Mr. Dean. They started with an initial pressure of 10 inches; and the system was only applied to part of the district, about 3 miles from the works. It was the most thickly populated area; and they had had considerable trouble in giving anything like decent pressure, owing to the distance, and so on. Starting with the 10 inches at the works, they got a pressure of 3½ inches 3 miles away. He quite agreed with the author as to the value of the system. If his Company had not adopted it, they would have had to go to very considerable expense in providing larger mains. The main through which the gas was boosted was a 12-inch one for the first 1¼ miles from the works, and 10 and 8 inches for the remainder of the distance.

In the course of a lengthy speech, Mr. Ainsworth said there was no doubt that the use of both incandescent and flat-flame burners created a difficulty in the matter of pressure. Mr. Dean told them that his initial pressure was 13 inches, which was subsequently reduced; but the pressure must vary in different parts according to the quantity of gas that was used. The variation of pressure was one of the reasons why gas companies needed to look after the burners. At Ilford air-adjusters were supplied for the "C" burners, which meant the saving of a lot of trouble where there was a good pressure. In their case it had done much towards stopping complaints. Wherever the pressure of gas was increased it required to be done very gradually. Another point bearing on the matter of pressure was the size of pipes in houses. He had just come across some houses that were being fitted with ¼-inch pipe; and, of course, where such a size was used there would, before it had been in very long, be trouble. Then, again, if the pressure was too high, it was difficult to get the gas-fires to work without noise. Even with a governor it was impossible always to regulate gas-fires; and so in suitable cases he fitted Carter regulators, which acted very well, though care required to be exercised with them. It was often said: "Get a good pressure;" but if they could only keep to 1½ or 2 inches all round, they could go along very nicely. Many people objected to noise; and with a high pressure there was noise. Therefore it was not wise to have too much pressure for house lighting. Of course, the noise was one of the drawbacks to the use of Kern burners. As to the flat-flame burners, at Ilford they used Bray's union-jet burners with economizers on the top. He asked how Mr. Dean got the pressure down in the district. Mr. Hollington inquired what was done in the matter of regulating the pressure in the street-lamps.

The President said he agreed entirely with Mr. Dean as to a few tenths more pressure making up for loss in illuminating power. Nothing caused greater discontent among consumers than giving them too little pressure. The 1½ or 2 inches mentioned by Mr. Ainsworth was very low; it should not be less than 3 inches in any district or house. There would not then be one-quarter of the complaints that there were at present. In the neighbourhood where he lived, there was never less than 4½ inches day or night. He had no trouble; and he was in a 14-candle gas district. Surely this went a long way towards showing whether 1½ or 3 inches was the better. How soon did the initial pressure at the booster fall from the 13 inches named? It seemed to him that if the gas had to travel far it would lose a great deal from skin friction, apart from supplying consumers. In Tottenham, he expected the gas would be taken off quickly; and probably the pressure was not more than 4 inches when it had travelled 3 miles. In Mr. Carpenter's case there was a loss of 2 inches a mile; and at Tottenham he (the speaker) thought that it would be nearly 3 inches. This corresponded with a paper read before the Institution last year, in which it was shown that pressure fell, even without any consumption, by about 3 inches a mile—due to skin friction. As to small fittings, he agreed with Mr. Ainsworth; much complaint was due to them. At the start they were all right; but after twelve months or so they commenced to rust. Therefore Mr. Ainsworth was showing vigilance, and looking after the interests of his Company, by going into new houses and inspecting the pipes. He was also quite right about the Carter valve, which should be placed out of sight, in case children turned it on for amusement. With regard to the union jet, too, Mr. Ainsworth was right. Wherever there was any proportion of carburetted water gas present, two-hole burners were better than slit ones with an economizer on top. The days when pressures had to be reckoned in tenths were passed; they now had to deal with inches. He pointed out that the noise in the Kern burner could always be obviated by increasing the number of holes.

In replying to the discussion, Mr. Dean referred first to Mr. Carpenter's question regarding the pressure at the point of consumption. He said that although the gas was sent out at a high initial pressure, the draught on the mains was so large that by the time it got through it was reduced to 3½ inches. This main was connected with a cross-piece supplying three high-pressure mains, one of which came back to the works; and to the dead-end at the works there was a pressure-gauge attached. This was studied, and as the pressure altered, so it was increased or decreased at the works, according to requirements. As to Mr. Scarth's query, there were, of course, other methods of driving booster fans—reciprocating steam-engines and gas-engines. But these all necessitated belting; and the turbine seemed the best way of doing it. By adopting this means, great control of the speeds was secured. There were four steam nozzles; and if a low pressure was required, the machine could be run with only two. Besides this, the plant took up little room, and there was no vibration. The pressure at any part of the district did not exceed 4½ to 5 inches; and, as the demand fell off, they gradually reduced the speed of the fan, till at last they used only the gasholder pressure. In reply to Mr. Hollington's question about the regulation of the pressure to the street-lamps, he said that none of the lamps in the vicinity of the gas-works were connected to the high-pressure main. They were connected to the main that supplied the consumers on its way back to the works.

The proceedings concluded with the passing of a hearty vote of thanks to Mr. Dean for his paper, on the motion of the President, seconded by Mr. Clark.

YORKSHIRE JUNIOR GAS ASSOCIATION.

The members of this Association assembled in large numbers on Saturday at the Leeds Institute, under the presidency of Mr. W. CRANFIELD, to hear the following paper, by Mr. A. EDWARDS, of the Leeds Gas-Works.

THE TESTING AND VALUATION OF GAS COALS.

The value of a coal from a gas manufacturer's point of view depends primarily upon the yield and quality of gas obtained on distillation and the quality and quantity of the residual coke. No ultimate or approximate analyses can furnish these particulars, and physical appearance is often misleading; so actual distillations must be made. Judging by recent publications, the method or magnitude of the distillation—whether a few pounds or a few tons of coal should be used—is still in question. Comparison is often made between the methods without a proper understanding of the aims of each.

The valuation of a gas coal to my mind involves a knowledge, first, of its maximum gas-making value, and, secondly, of its behaviour under actual carbonizing conditions—points which cannot be obtained, or only with the greatest difficulty, in one and the same plant, and which often may bear opposite signs in the summation of its value. To obtain the maximum value, we must necessarily have absolutely tight retorts and perfect carbonization. This vetoes the use of clay retorts and an exhauster, and restricts us to the use of iron retorts, and, since their life is short and their cost high, of small capacity. The behaviour of a coal under manufacturing conditions can only be obtained by employing plant composed of units of manufacturing size. The aim should be to use plant of a capacity that will suffice to pass through the condensers a gas of uniform quality, produced by charges in varying stages of carbonization. No less than six retorts should be used, charged (say) in rotation at intervals of an hour. A single retort set aside in an arch—a favourite method at some works—is of less value, and cannot be recommended.

I will briefly summarize the requirements, with their advantages and disadvantages.

Small Scale Distillations.—Small iron retorts are used, carbonizing either 2·24 lbs. or 22·4 lbs. heated by gas or coke, with small condensers and purifiers, but without hydraulic mains or washers, a meter, and a couple of counterbalanced holders sufficiently large to store the whole of the gas from a charge. The advantages are: Speed of operation; each charge requiring from 30 to 40 minutes to carbonize, so that three charges (the minimum number that will give a true result) can be worked off in from 1¾ to 2¾ hours. The plant is easily handled, and the heats can be maintained at any particular temperature desired; the results are strictly comparable; and it offers the only method of rapidly checking deliveries. The disadvantages are: A much higher yield of gas and illuminating matter than can be obtained in ordinary working; a higher yield of tar; uncertainty in the amount of ammoniacal liquor produced; relatively higher value given to small coal than can be realized in practical working; and uncertainty as to the working value because of the intermittent flow of gas.

Large Plant.—A complete setting, or number of settings, of fire-clay retorts of the same size as those used for manufacture. Hydraulic mains, condensers, exhausters, washers, scrubbers, and purifiers, preferably worked in the same manner as the manufacturing plant. A fixed proportion of the make to be accurately metered into small test holders. The advantages are: It offers us a means of ascertaining the most advantageous methods of carbonizing the coal applicable to the manufacturing scale. We get a much better idea of the value of the coke, and the amounts of tar and liquor. The quantity and quality of the gas from different coals or mixture of coals, provided the condensing arrangements and the state of repair of the two plants are similar, approximate to that obtained in routine manufacture. In this connection, it is possible that the regular flow of gas from such an installation may slightly vary the comparative values of two coals of different characteristics, as found by the small plant. The presence or absence of tendencies to cause stopped pipes and pitched mains can readily be noted. The disadvantages are:

The difficulty of maintaining the desired heats regularly; the large quantity of coal required and the length of time it takes to complete a test; the difficulty of metering exactly a proportional part of the make for ascertaining the illuminating power and the calorific values, &c.; the uncertainty introduced by the leakage of gas from, or furnace gases into, the fire-clay retorts (this increases with their life); and the personal equation in charging.

I regard the small-retort method as the only practical way of quickly valuing a coal, which value, if found satisfactory, can be confirmed or modified during the receipt of the bulk of the coal by analyses made on the large scale. Where, as in the works on which I am engaged, 50 to 60 different varieties of coals are used, the small-scale method is the only one that can be employed to check and ensure constant deliveries; this is one of its greatest uses. The greatest value of the large-scale method lies in checking carbonizing methods, incidentally utilizing the points mentioned before in ascertaining the intrinsic value of a coal.

Disposition and Working of Small Plant.—The various parts should be installed under the same roof, if possible, so that they are subjected to the same temperature influences. Housing the retort-bench and meter, but relegating the condensers, purifiers, and holders to the tender mercies of all the winds that blow, is defective. The plant should be so disposed that the variation in temperature of its surrounding atmosphere is a minimum; and this variation should affect all parts equally, securing constancy in their relative temperatures. The variable results often found in these plants can be traced to condensation. The particular design of apparatus provided to effect this object—the temperature of its coolest part—and the manner in which the tar elects to settle out and flow to the wells or draw-off cocks, have great influences upon the illuminating power.

Elaborate condensing arrangements are not necessary in the smallest plants. A continuation of the ascension-pipe, provided with one or more chambers or boxes of larger area, is all that is required. The object is to allow the gas to travel slowly through the plant, and give the tarry particles time to settle by gravitation, instead of removing them by friction. Anything in the nature of gauze surfaces presented to the flow of gas certainly arrest the last particles of tar, but soon become coated with a layer which ultimately depresses the illuminating power by reason of the solvent action of the tar on the light-giving hydrocarbons. In the absence of the hydraulic main, the whole of the tar goes forward with the gas; the particles gradually falling out and flowing to the outlets, while the temperature of the gas cools to that of the atmosphere. As the gas and tar cool together, the latter naturally absorbs a proportion of the lighter hydrocarbons, varying in quantity with the temperature and the time and manner of contact with the gases.

Of these variables, temperature is known, as it varies directly with that of the surrounding atmosphere. With the plant under my own observation, the illuminating power increases 0·1 candle for every degree Fahrenheit increase in temperature above 60°; the limiting points being 60° and 73°. The maximum difference between summer and winter extremes affects the plant to this extent; so that it is possible to have a difference in illuminating power, with the same make of gas from the same coal tested at these periods, of $1\frac{1}{8}$ candles. Both the value of the constant and the range of limiting temperatures may vary with the different plants, so that each observer must determine its value in his own case. Water-cooled condensers cannot be regulated successfully to maintain one even temperature, and at the same time allow of the condition being repeated in subsequent distillations.

The other variable—the manner in which the tar deposits and flows through the condenser—is the one great bugbear of these plants, and is responsible for the diverse results so often found. Despite the greatest care, the tar will sometimes stick to the condenser surfaces and refuse to flow to the outlets. The deposit often grows with each successive charge; increasing rapidly towards the end, until finally it becomes so large as to throw a considerable back-pressure upon the retort. Before this happens, there is always a decrease in illuminating power, which can only be gauged by its effect upon a coal of known value; the correction found being added to the succeeding charges of an unknown coal. Clearing out the condensers frequently, by steaming if necessary, is the only way of minimizing this trouble. The quantity of tar obtained in regular working should be closely watched; and if it shows signs of permanently falling below the normal, steps should at once be taken to clean the condensers.

Dry coals aggravate the trouble, as well as those which yield only a small quantity of liquor. It is interesting to note that these coals are just those most prone to cause stopped pipes and pitched mains. The tar is often held up for a few charges and then comes down in those which succeed. This often happens when a coal giving much liquor follows those deficient in this respect. In every case it is accompanied by an increase in illuminating power. Where this happens, the charges should be rejected until condensation proceeds normally. Conversely, when a coal producing little liquor follows one giving much, the illuminating power falls; and here again the charges should be continued until the illuminating power becomes constant.

The discontinuous nature of the distillation is largely responsible for the erratic behaviour of the tar; and in this connection it is worth noting that some of the results found by carbonizing at increased temperatures in these small retorts are vitiated by the fact that we get a proportionately slower flow of the heavy tars through the condensers, which has a depreciating effect upon the illuminating power to such an extent that it is possible to show a marked falling off in sperm value above a certain temperature and make of gas—results which are entirely modified when the product of several charges at varying periods of carbonization are delivered through the hydraulic main into the usual foul main and condensers.

The use of a washer is superfluous, as the conditions applying in actual manufacture can never be approximated, the quantity of water being so small; while if it is increased to render it workable, it introduces uncertainty into the analysis without any compensating results of value. Oxide or lime should be used for purification, adopting the method employed on the large works; and the gasholder should be counterbalanced to throw from 1-10th to 2-10ths pressure.

The illuminating power of the gas is ascertained by burning in the standard 24-hole burner at a rate to give the highest results. The flame is a much shorter one than is given by gas made in a clay retort and with an exhauster; and if tested uniformly, either at the 5 cubic feet rate or with the 16-candle flame, it will in most cases give low results. A flame of 18 candles in value, increasing until it just begins to tail over the chimney, gives, in the majority of cases, the highest efficiency. As a standard of comparison, candles are of no use. The Harcourt 10-candle lamp should be employed when possible; but a good working standard—one which I have found to be of great constancy—is furnished by the Methven slot, burning the gas made in the small retort—that is to say, burning the same gas at both ends of the photometer bar. The Methven screen, using ordinary town gas, is not reliable, varying from 1·82 to 1·92 candles in value with the composition of gas, due, no doubt, to the differing quantity of nitrogen drawn in through the clay retorts.

The water in neither the meter nor the holders should be changed, but only fresh water added from time to time to make up for the loss due to evaporation. Where this course is followed, it is not advisable to allow the gas to stand in the holders for (say) several hours, but to test it at once. When the plant is started again after remaining idle for some time, several charges of coal must be put through, in order to saturate the apparatus; otherwise low results will be obtained.

The coke, when drawn, should be spread on a large iron plate to cool or air-slake quickly, or be collected in a small iron box, provided with a fairly air-tight lid, and weighed when cold, portions being preserved for analysis if necessary. A record of its appearance, firmness, and size should be kept. In this connection, it is well to note that the speed with which the carbonization is conducted tends to make the smaller coals and nuts cake more than they do when treated in the ordinary retorts. A coke of this description, classed as fair from the evidence of the experimental retort, would break up when carbonized on the large scale, producing a considerable quantity of breeze.

Statement and Commercial Valuation of Results.—All measurements should be reduced to standard temperature and pressure, the results stated on the ton basis, and the illuminating value of the gas calculated to equivalent pounds of sperm.

$$\log.\ (\text{sperm value per ton}) = \log.\ (\text{cubic feet of gas made}) + \log.\ (\text{illuminating power}) + \bar{3}{\cdot}53511$$

or

$$\frac{\text{cubic feet of gas made} \times \text{illuminating power} \times 24\ (\textit{i.e.}, \text{grains of sperm per candle foot})}{7000\ (\textit{i.e.}, \text{grains in 1 lb.})}$$

The weights of the various products are summed up, allowing about 30 lbs. to 40 lbs. for impurities and loss, and the excess or deficiency noted.

Despite the great difficulty, it is highly desirable that some concrete commercial value in £ *s. d.* should be attached to the coals, based upon their analysis. The values of tar and of liquor, where the latter is known, are soon determined; but it is different with gas and coke. An obvious course to adopt with gas is to base calculations on the sperm value; it cannot, however, apply universally. A coal producing 10,000 cubic feet of 18-candle gas would generally be of more value to works saddled with an 18-candle standard than one producing 12,000 cubic feet of 15-candle gas, though in each case the sperm value is the same. These values would, of course, be reversed in the case of works supplying 15-candle gas.

Calorific power and calorific yield must also have consideration equally with illuminating value, notwithstanding the fact that we have not yet convinced the "powers that be" that the latter occupies an anomalous position in the scale of values, judged by modern methods of lighting. Though the calorific power is generally greater the higher the illumination power, it is not universally so with different coals; while the calorific yield per ton is decidedly in favour of the one producing the larger volume of gas. Put in other words, the calories per pound of sperm value are greater in the case of the coal giving the larger yield of gas of lower illuminating power. This naturally complicates the question of monetary valuation.

Where enrichment costs very little, as in some places in which water gas is used, the values are based principally upon the yield of gas and its calorific power, ignoring the illuminating power, and following the manufacturing policy of squeezing the utmost possible volume from the coals. Large works, using considerable quantities of different kinds of coal, can afford to determine values

on a broader basis than smaller ones, in which the kinds are restricted to three or four at the most. It should never be a recommendation to small works that, according to the seller, some larger neighbour is using his coal.

Calculations based on the sperm value, modified, if desired, by calorific yield, give the readiest means of valuation, and suit the conditions of those works with a moderate standard of illuminating power. These values can never be absolute, but they should aim to be comparative. The method is applied in the following manner: The main value of the coal is considered as resting with the sperm value. Standards of value for residuals and calorific yield are made, and the excess or deficiency of each coal in this respect is either added to or deducted from its main value. A standard for sperm value is also made, excess or deficiency meaning either decreased or increased carbonizing costs per 1000 cubic feet over the average found in actual manufacture; and this excess or deficiency is valued at the same rate as the bulk of the sperm value, and is either added to or deducted from its main value as the case may be. The standards of value are arrived at by averaging the prices and results obtained from the coals in use, or they may consist of equivalent averages of the coals tendered. For the sake of illustrating the method, the analysis of two coals, A and B, are tabulated.

—	Price.	Gas Made per Ton.	Illum. Power.	Sperm Value.	Tar.	Liquor.	Coke.
	s. d.	Cub Ft.	Candles.	Lbs.	Galls.	Galls.	Cwt.
A	8 11	11,000	17·00	641	13·00	20·00	12·50
B	9 2	11,500	16·80	662	12·00	13·00	13·00
Aver.	9 0½	11,250	16·90	651	12·50	16·50	12·75

	A	B	Aver.
Calorific value in B.T.U.	675	670	672·5
,, yield per ton in thousands of B.T.U.	7425	7705	7565·0

Taking the averages as the standards, we get—

Gas.

	s.	d.
Value of illuminating matter, at 1d. per 6 lbs.	9	0½
,, ,, calorific yield, at 1d. per 69,723 B.T.U.	9	0½

Residuals.

Value of tar, at 1½d. per gallon	1	3½
,, ,, liquor	..	
,, ,, coke at 8s. per ton	5	1¼
Total as standard for residuals	6	4¾

Pricing out each coal, we get—

A.—*Gas.*

			s.	d.
Sperm value, 641 lbs.			8	10¾
Deduct for low yield, 10 lbs.		d. 1¾		
,, ,, ,, of B.T.U., 140,000		2		
		6s. 4¼d.		

A.—*Residuals.*

Tar, 13 gallons	1s. 4½d.			
Liquor	..			
Coke, 12 cwt. 2 qrs.	5 0			
Deduct for low yield			¾	0 4¼
Net value			8	6½

If desired, the calorific value may be ignored. The net value then becomes 8s. 8½d.

B.—*Gas.*

	s.	d.
Sperm value, 662 lbs.	9	2¾
Add for higher yield, 11 lbs.	0	1¾
,, ,, ,, of B.T.U., 140,000	0	2

B.—*Residuals.*

Tar, 12 gallons	1s. 3d.			
Liquor	..			
Coke, 13 cwt.	5 2½			
Add for higher yield			0	¾
Net value			9	7

If the calorific value is ignored, the net value becomes 9s. 5d. The quantity of liquor given in the analysis is that condensed; but as it does not bear any definite relation to the amount produced on the manufacturing scale, we cannot attach any monetary value to it. Remember, however, that this virgin liquor has a distinct value in keeping the pipes and mains free from pitchy obstructions. The difference in price between these coals, if both are equally worth buying, should be 1s. 0½d. if the calorific power is taken into account, and 8½d. if ignored. Evidently B has the better value, and the supplier of A should lower his price.

The foregoing method is largely empirical, and rather magnifies differences. As the values of coals in the future will depend more upon the make of gas per ton, and little consideration will be had for illuminating power, probably the following process will find more favour: The values of the various products are worked out at their prevailing market prices, and the coal debited with the costs of manufacture, distribution, management, &c. I find the best plan to adopt is to reckon the actual carbonizing costs at the ton rate, and take the rest of the charges at the 1000 cubic feet rate. I will take for example the following data:

Leakage, 6 per cent. of the gas made.
Coke used for firing, 2 cwt. per ton of coal.
Gas rental, 2s. 0·5d. per 1000 cubic feet.
Carbonizing wages, 2s. 9·2d. per ton.
Other charges—
Manufacture, distribution, &c., 8·30d.
Interest, sinking fund, &c., 7·56d. } 15·86d. per 1000 c. ft.
Coke sold, at 8s. per ton.
Tar ,, ,, 1¼d. per gallon.

A.—*Total Revenue.*

	s.	d.
11,000 c. ft., less 6 p. ct. = 10,340 c. ft. at 2s. 0·5d.	21	1·33
Coke, 12 cwt. 2 qrs., less 2 cwt. = 10 cwt. 2 qrs. at 8s. per ton	4	2·40
Tar, 13 gallons at 1¼d. per gallon	1	4·25
Liquor	..	
Total	26	7·98

A.—*Total Expenditure.*

Carbonizing 1 ton of coal	2s. 9·20d.		
10,340 c. ft., at 15·86d. per 1000 c. ft.	13	7·99	
		16	5·19
Net value		10	2·79

B.—*Total Revenue.*

	s.	d.
11,500 c. ft., less 6 p. ct. = 10,810 c. ft. at 2s. 0·5d.	22	0·84
Coke, 13 cwt., less 2 cwt. = 11 cwt., at 8s. per ton	4	4·80
Tar, 12 gallons, at 1¼d. per gallon	1	3·00
Liquor	..	
Total	27	8·64

B.—*Total Expenditure.*

Carbonizing 1 ton of coal	2s. 9·20d.		
10,810 c. ft., at 15·86d. per 1000 c. ft.	14	3·44d.	
		17	0·64
Net value		10	8·00

In valuing coke, due regard must be paid to its content of ash and the quality of locally competing coke. The question of the quantity of sulphur in the coal is one of minor importance. Coals properly screened and picked vary little in value. Unscreened coal is subject to the greatest fluctuation, while nuts occupy an intermediate position. Washing the coal tends to make it more uniform; nuts most treated in this respect are increased in value from 4 to 8 per cent., depending upon the amount of shale and dust in the original coal. In conclusion, I would point out that reliable values can only follow correct sampling.

The paper was closely followed, and gave rise to an interesting and useful discussion, in which an animated exchange of question and answer largely took the place of set speeches or criticisms. Among others, the following points were raised.

Mr. NUTTALL (Keighley) inquired the reason for the deduction of 1½d. on account of the low make in one case and the addition of 1¾d. in the other. Seeing that a price had already been arrived at on the basis of the sperm value, was not the course adopted allowing twice over for the deficiency or excess of illuminating power?

Mr. EDWARDS explained that apportioning carbonizing costs according to gas made would result in an undue charge on a coal giving a good yield of gas, unless some correction were made; and he introduced the correction in this form in order to equalize the incidence of the carbonizing charges.

Mr. DEMAIN (Otley) wished to know why Mr. Edwards did not include the liquor in his estimate, seeing that it was always a definite source of income. Surely, he said, some allowance could and should be made.

Mr. EDWARDS replied that no reliable guidance was afforded in carbonization by a small experimental plant, seeing that the gas was not washed, and thus only the virgin liquor was produced. Besides, the amount of ammonia producible from different coals varied but slightly; far greater differences resulting from the carbonizing methods employed than from the composition of the coals themselves.

In reply to a question by Mr. SUTCLIFFE (Bradford),

Mr. EDWARDS explained that his rejection of the Methven screen as usually employed—viz., with the town gas—was based on the decrease in its accuracy as the percentage of nitrogen in the gas rose. This was frequently 8 or 9 per cent.

The PRESIDENT asked if the words "varying from 1·82 to 1·92 candles in value" referred to the actual value of the nominal 2-candle standard; and, if so, how had it been determined.

Mr. EDWARDS said that this was his meaning, and that the correct value had been determined by testing the Methven standard against the Harcourt 10-candle pentane lamp.

The PRESIDENT then asked why candles were of no use as a standard of comparison, and why the flame of the gas from the sample carbonized was much shorter than that of the gas as ordinarily made from the same coal.

Mr. EDWARDS replied that he thought the nitrogen in the ordinary gas was what spread out the flame, making the combustible constituents travel farther in order to get the air necessary for their combustion. In addition to the recognized objections to candles as a standard on account of the uncertainty of their emission of light, the time necessary for tests rendered

them unsuitable for use in connection with a small experimental plant working on a rapid succession of samples.

Mr. J. F. SMITH (Halifax) asked if the plant described had been constructed with all its parts bearing the same proportion to the corresponding parts of the works plant, as he considered it highly important that this should be the case. He had worked with experimental plants of from 2½ lbs. to 5 tons capacity, and had found a scrubber to be both desirable and successful. In this matter he disagreed with the author of the paper. With a 56-lb. plant, duly proportioned in all its parts to those in the large plant, he had found the results on the large and small scale to be within 5 per cent. of each other, and had never known a difference of more than 10 per cent. He deprecated a too ready attribution of stopped ascension-pipes to the dryness of the coals, and he asked the author if he would advise watering them. [Mr. EDWARDS: Certainly not.] In any case, the water present had a baneful effect on the amount of carbonic acid produced. Stopped pipes were largely a question of temperature. If the coal was backed up away from the mouthpiece, and a space thus left in which the gas could be roasted, stopped pipes might be expected. Knowing this, stokers would sometimes be caught leaving part of a charge in the mouthpieces of the retorts the ascension pipes of which showed a tendency to become blocked. Dust was another important factor in these obstructions, as could be proved from the analysis of the stuff removed from blocked pipes. He thought the possibility of using water-cooled condensers had been rather too lightly brushed aside. He had used them, and found that with water drawn from a deep well, and warmed by traversing a pipe along the retort-house, the condensers could, by the careful use of suitable appliances, be employed under uniform and satisfactory conditions. He could hardly endorse the author's great difference between the nitrogen percentage of the gas from clay and iron retorts. He usually found them fairly near together, and from 1½ to 2 per cent. in each case. Was the 30 to 40 lbs. due to loss, impurities, &c., to be guessed or inferred from a cursory external examination of the coals? or how was it to be decided? [Mr. EDWARDS: A fixed allowance for all coals.] Then he should prefer that the impurities should be actually determined, especially the carbonic acid, which might vary greatly, and with some hub coals might even be as high as 8 per cent. Referring to the second scheme of valuation, he could not agree to charge leakage against the coal, as it was not the fault of the coal; neither did distribution charges fairly fall upon it. The better method was simply to estimate the charges that came upon the gas as delivered into the holder. The other plan actually penalized a good coal, charging more against a coal that yielded 11,000 cubic feet than one yielding 10,000 cubic feet.

Mr. EDWARDS, in reply to the last speaker, said he generally found about 15 per cent. difference between the results of the works plant and the experimental plant; but he imagined that it could be reduced to 5 per cent. with very sound retorts, lids, &c. The nitrogen contents of the gas of the experimental plant was, of course, lower than that of the town gas; but, in his experience, he had not found it in the latter to be below 5 per cent. He was quite unconvinced of the value of scrubbers or washers in a plant of 100 tons capacity. It introduced other disturbing influences without any compensating advantages, inasmuch as a knowledge of the amount and value of the liquor was of very little consequence. He would again call attention to the incidental advantage of the coals not being too dry, inasmuch as the steam from them helped to keep the tar flowing. The whole question of the type of condensers hinged upon illuminating power; and he was still unconvinced that on a small plant he could get the same gradual cooling and natural sequence of reactions with a water condenser as with an atmospheric one under the conditions of shelter and temperature as mentioned in the paper. He quite recognized that at high temperatures iron retorts became distinctly porous, as was seen by the gradual carburation of the iron. He likewise agreed with the advisability of an exact determination of the amounts of impurities, at least in some cases—certainly with carbonic acid if not with sulphuretted hydrogen. In regard to the method of making charges against the gas for distribution, leakage, &c., he adhered to his scheme.

Mr. BOOTH (Huddersfield) renewed the attack on this latter point; claiming that in comparing the values of coals only works charges should be reckoned against them. He asked the author if he made any allowance for differences of carbonizing methods and the suitability of the coal to those in use, and its behaviour during carbonization—for example, the lesser yield from a small coal with much dust, because it could not be uniformly charged into inclined retorts.

Mr. EDWARDS replied that such matters could not possibly be reported on from tests in a 2½-lb. plant, and must therefore be noted in actual large-scale working.

Mr. PARRISH (Dewsbury) asked if the author had had any experience of various thicknesses of retorts as affecting the yield. [Mr. EDWARDS: No.] While the washing of coal certainly tended to decrease the amount of shale, pyrites, &c., did he not find that, though nominally dry again, the coal had absorbed additional water from which it would not easily part, and thus the washing might increase the gaseous impurities, while decreasing the make per ton.

Mr. EDWARDS said his experience was that, on the contrary, one got an increased yield of gas with damp coals.

Mr. SUTCLIFFE (Bradford) referred to the author's valuation of coal in terms of sperm value, and proceeded to criticize schemes sometimes given in works of reference. He personally favoured the calculation of the actual money receipt per pound of sperm value, and the comparison of coals from this. In many large works, the coals were compared on the basis of the candle-feet per ton.

The PRESIDENT, in closing the discussion, raised the point that no reference had been made in the paper to any examination of the character and contents of the tar, and mentioned that though the quantity would be but small from a test, and though the tar buyer would purchase the tar at an agreed price, yet he would first ascertain its value by distilling it, and would seek to alter his price if the value decreased very much. He was rather amused at the curt dismissal of candles as a useless standard, when the chief subsequent valuation of the coals rested on sperm value. Though the time might not yet be ripe for the change, calorific value would assume the more important place in coal valuation which it would eventually occupy in gas valuation. He was glad the paper so strongly insisted on the paramount importance of tests being strictly comparable, as a great deal of information and many statistics were showered upon the gas industry, the value of which was sadly diminished by want of knowledge of the full conditions, so that the collecting of such statistics was often a delusion and a snare. He would call attention to the need of sampling only freshly arrived coals, seeing that those generally held occluded a large amount of gas, chiefly methane, in ordinary coal, while cannel was exceptional in thus holding a notably large amount of ethane—a rich illuminant. The loss of this gas had thus an important influence on the whole question of coal storage in gas-works, as also in determining the proper time for testing the coal. This emission of occluded gas was recognized and dealt with on ships carrying coal cargoes; and it might well be remembered in gas-works, especially as it had so important a bearing on the calorific, as opposed to the illuminating, value of gas to increase the methane, especially if it could be done at the expense of the hydrogen or carbonic oxide.

At the close of the meeting, a vote of thanks was heartily accorded to Mr. Edwards for his paper.

Accidents to Workmen in France.—Statistics recently published in the "Journal Officiel" show that between July 1, 1899, and Dec. 31, 1903, there were 44,163 accidents to workmen, of which 6962 were fatal, and 756 resulted in total incapacity. Of the entire number, 9093, or 20·59 per cent., were connected with the metal trades; but only 185 were recorded in gas-works.

Natural Gas in Canada.—In a report on the mineral productions of Canada last year, it is stated that there was a somewhat increased output of natural gas in Ontario, due entirely to operations in the Welland field; production in the Essex field having dropped to very small amounts. The development of the gas-field at Medicine Hat, North-West Territories, seems to have been continued with much success. The Gas Commission of the town has now six producing wells, one of which has been put down to a depth of nearly 1000 feet, yielding 1,125,000 cubic feet per twenty-four hours.

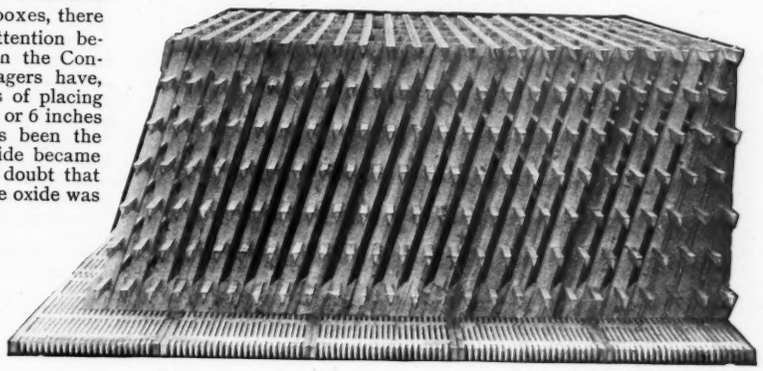
London Borough Councils and Electric Fittings.—In view of the unsuccessful attempt made by Sir F. Banbury a few weeks ago to get the House of Commons to exclude from the General Powers Bill of the London County Council the part sanctioning the supply of electric-light fittings, &c., by Borough Councils, the General Secretary of the Ironmongers' Federated Association (Mr. R. H. Smith) is sending out a circular to parties interested in the matter, urging that some action should be taken, when the Bill comes before the Police and Sanitary Committee, to induce them not to allow the ratepayers' money to be expended in promoting one class of lighting at the expense of another.

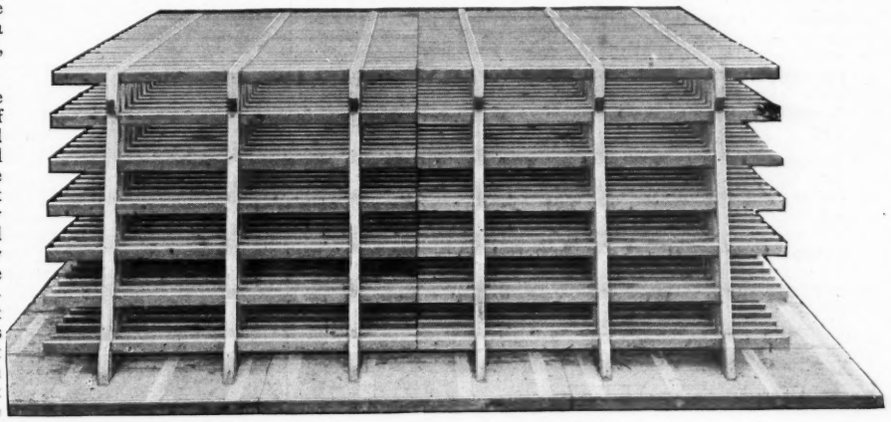
Benzols as Light and Heat Producers.—A short time ago, a patent was taken out by MM. P. Léotard and H. Dignef for a process for the production of light, heat, and power from heavy benzols. It consists in carburetting air with heavy benzol of about 0·910 sp. gr. According to an abstract of the specification in the "Journal of the Society of the Chemical Industry," air is drawn from the atmosphere through a valved pipe into a gasholder, which is lifted by a piston worked by water under pressure. When full, the supply of water is cut off automatically, and the holder descends by its own weight, and drives the air into a second holder which serves as a pressure equalizer. From this second gasholder the air is forced by the weight of the holder into the carburettors. The latter are in duplicate, and worked alternately, in order that when one apparatus works badly, owing to the low temperature produced by the evaporation of the benzol, it can be cut out and the other used. The carburettor is a vessel the lower part of which serves to hold the benzol; while over the surface of the latter is a horizontal perforated partition. Tubes filled with broken pumice and with wick are fixed in these holes to dry the gaseous mixture. The air is introduced by a bell-mouthed pipe, with the opening covered by gauze, under the surface of the benzol. It bubbles up, and after passing through the drying-tubes, it is further dried by broken pumice and calcium contained in the upper compartment of the carburettor. A screw-shaped fan or propeller is situated in the pipe conveying the gas from the carburettor to the pressure-regulator and the main. It rotates in the current of gas, and serves to complete the mixing of air and benzol vapour.

SPENCER'S VERTICAL HURDLE GRID.

Following upon the years of well-established custom in the matter of purification in ordinary purifier-boxes, there has of late been a considerable amount of attention bestowed on the subject, both in this country, on the Continent, and in the United States. Gas managers have, among other things, tried all kinds of methods of placing oxide in purifiers. First, in shallow layers of 5 or 6 inches deep; but the difficulty with deep layers has been the cause of enormous back-pressure before the oxide became fully spent. It has now been proved beyond doubt that the fault lay in the crude manner in which the oxide was placed in the purifier; for, however careful in laying oxide on the old system, it is certain to offer excessive resistance, and to consolidate by its own superincumbent weight.

Various proposals have been made to overcome this difficulty; and we are invited to notice the plan which Mr. Walter Spencer, of Elland, describes as his vertical hurdle grid. The simple construction of the grids enables them to be placed in position in the box with ease and rapidity; the grids being merely formed of a rectangular frame, with crossbars, diamond shaped in cross section.





Looking at the illustrations, the first is an end view of a batch of grids set in position; and the second a side view. From No. 1, it will be seen that the first grid in the row is of wedge shape. The object of this is to give the necessary angle, to bring the diamond-shaped bars of each successive grid below the spaces between the bars of the preceding grid. Suppose, for example, that we take a box 20 feet square. In this case the grids would probably be made 5 feet long, so that four rows of them and eight wedged pieces—one at each end of each row—would be required to fill the box. The grids, it is proposed, should be supported as shown in the illustrations, on a tier of ordinary grids for the accumulation of the gas, and to keep the bottom of the box free from purifying material.

The filling of the box with material is performed by means of the ordinary appliances; and, as the bars are 3½ inches apart, the oxide readily falls to the bottom, and builds up in horizontal layers of even compactness. If necessary, the purifiers can be fitted 8 to 10 feet deep with these hurdle grids; and gas can be passed through a layer of this depth with scarcely any back-pressure.

In cases where the boxes are elevated, a special wedged-shaped grid is fitted over the discharge-shoot. When the box is to be emptied, this grid can easily be pulled out, which relieves the grids on either side. The grids can then be removed one by one, and the oxide be shot down the discharge-shoot. It is not necessary to take all the grids out of the box. Most of them can be placed behind as the process of emptying proceeds; and after, say, one-half of the box has been emptied, and grids can be restored to their working position—that is to say, half of the box can be again filled while the other half is being emptied. With boxes not provided with discharge-shoots, it is only necessary to pull out the wedge-shaped grids at one end and shovel out the oxide in that space. This will relieve the next grid, and so on.

As has been indicated, the grids can be used in existing boxes without any modification whatever. It is claimed that they have proved to be more than double the purifying area; that, where used, the boxes can be filled in half the time required when ordinary grids are employed; and that back-pressure is almost entirely avoided. The grids are in operation at the Elland Gas-Works, and are reported to be giving complete satisfaction.

A Large Pumping-Engine.—The Board of Public Service of Kansas City (Mo.) have recently contracted for a pumping-engine for the Turkey Creek pumping-station in the city. The engine, which is to be of the vertical triple-expansion type, will have a capacity of 20 million gallons per day, pumping against a domestic head of 340 feet and a fire head of 410 feet. While neither the design nor the capacity of the engine is unusual, "Engineering Record" points out that, taken in connection with the high head pumped against and the moderate speed of operation, it becomes notable as being the largest water-works pumping-engine in America, and perhaps in the world. The steam cylinders are 40, 72, and 108 inches in diameter, and 66-inch stroke; the speed being 20 revolutions, or 220 feet piston speed, per minute. The guaranteed duty of the engine is 170 million foot-pounds, and the weight will be about 800 tons.

"Mechanical Handling of Material."—We have received from Messrs. Crosby Lockwood and Son a volume bearing the above title by Mr. G. F. Zimmer, Assoc.M.Inst.C.E. It is a valuable treatise, occupying 510 pages, on the handling of material such as coal, ore, timber, &c., by automatic machinery; and the text is accompanied by 550 illustrations. We purpose noticing the work more fully in a subsequent issue.

"Trade Unions" is the title of a small book of which we have just received a copy for review. The author is Mr. Geoffrey Drage; and he has dealt carefully with what is an admittedly difficult subject. He sketches the history, and points out the functions, of Trade Unions; and in an appendix are set forth recent legal decisions affecting these bodies. We may later on find an opportunity of noticing at greater length what Mr. Drage has to say.

Breaking of a Submerged Water Main through Ice.—The breaking of a submerged water-main which supplies water to a portion of the village of Potsdam (N.Y.) was caused recently by the pressure of ice and the undermining of the main. The main is a 6-inch cast-iron pipe, laid on the bed of the Raquette River. It appears, from particulars in "Engineering Record," that a strong current along one shore had washed the soil from beneath the pipe near the point where it leaves the bed of the stream, and left it unsupported for some distance. The weight of 20 to 30 inches of ice, which had formed on the river, was brought on the unsupported pipe during low water, forcing it down and breaking it. Owing to the severity of the weather, considerable difficulty was experienced in making repairs. The ice over the pipe was first removed, then a trench was opened, the pipe raised, and a collar leaded on over the break. After this the pipe was lowered and again secured in its place.

Over-Heating of Stored Coal.—The precautions that should be taken against the over-heating of stored coal (it is said in "Technics") are simple. It should never be heaped if thoroughly wet, and should be kept in iron and concrete bunkers in a cool place not adjacent to boilers or flues. The pile should never exceed 12 feet in depth, and should be arranged with efficient ventilating spaces round the sides and at the bottom. In the event of combustion or over-heating occurring, the best plan is to turn the coal over thoroughly. Pouring water on the top of the heap is of little use, as it may only penetrate sufficiently to make matters worse. If turning over is impossible, and the heart of the pile is suspected to be alight, an effective method is to ram in a good-sized pipe drilled at the end with several holes. When this has penetrated the surrounding coked fuel, a stream of water should be turned on to it, which will speedily result in the extinction of the fire.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Institution of Gas Engineers and Gas Testing.

SIR,—Having read the letter in your last issue relating to the action of the Council of the Institution of Gas Engineers with regard to the recommendations of the Departmental Committee's report on gas testing, I cannot think Mr. Carr is really serious in his contention that the Council has acted in this matter without authority. It will be noted that Mr Carr carefully avoids the main question of gas testing; and I have neither the time nor the inclination to enter into any public correspondence upon side-issues. The recommendations of the Board of Trade have been considered at two general meetings of the Institution, and at several meetings of the Council, and at all and every meeting the recommendations have been unanimously, emphatically, and most properly condemned.

D. IRVING.

Bristol, April 15, 1905.

The Estimates for the Devonport Gas-Works.

SIR,—In the article in the last issue of the "JOURNAL" on the Devonport Gas-Works, you say, almost at the end: "It is, however, a legitimate subject of inquiry to ask how far the results compare with the estimate, and what prospect there is of realizing the expectations formed by the consultants." So far as the works have proceeded and the contracts let, the actual cost is less than the amount of our estimate. We estimated for contracts Nos. 3 to 7 a cost of £25,100. The works embodied in these contracts are largely completed; and we anticipate a very small amount of additional costs to the contracts in hand. So far as can be ascertained, they will be completed at a cost of slightly under £24,000.

As to the prospect of realizing the expectations formed by us, that can only be proved by actual working; but although we have continually urged the new retorts and other necessary works, up to the present time the order to commence them has not been given.

STEVENSON AND BURSTAL, MM.Inst.C.E.

38, *Parliament Street, S.W., April* 13, 1905.

APPLICATIONS FOR LETTERS PATENT.

6408.—FLETCHER, RUSSELL, AND CO., LTD., and NEIL, J. & W. R., "Gas-burners." March 27.
6433.—MORTON, G. L., and CROSTA, L. W., "Gas-producers." March 27.
6434.—CROSTA, L. W., and MORTON, G. L., "Gas-producers." March 27.
6446.—PAYNE, C., and CLARKE, C., "Incandescent burners." March 27.
6542.—HIRST, H. and CASH, F. T., "Gas-fittings." March 28.
6548.—BIHELLER, S., "Globe supports." March 28.
6563.—WILTON, G., "Purification of gas and recovery of bye-products." March 28.
6575.—SCHAEFFER, J., "Inverted burners." March 28.
6615.—EDGE, H., "Air and gas self-intensifying apparatus for use in connection with internal combustion engines." March 29.
6662.—BIER, G. & J., and SENSENSCHMIDT, M., "Bunsen-burners." March 29.
6666.—BOUSFIELD, J. E., "Inverted gas-lamps." A communication from the firm of Julius Pintsch. March 29.
6688.—BRAYTON, H. R., "Incandescent burners." March 29.
6794.—BELL, H. P., "Manufacture of gas." March 31.
6873.—WINDHAM, F., and THOMSON, G. L., "Generation of acetylene." March 31.
6878.—BERNHARDT, L., "Acetylene-generators." March 31.
6907.—HELPS, G., "Bulbs and chimneys for inverted burners." April 1.
6995.—PYE, T. E., "Valves." April 3.
7003.—HINDEN, A., "Automatically igniting and extinguishing gas-lamps." April 3.
7040.—CAFFARO, G., and BRACCO, J. V., "Gas-meters." April 3.
7042.—YOUNG, B., "Incandescent burners." April 3.
7077.—BOWRON, G., "Photometers." April 4.
7107.—ROESSLER, A. C., and the AIR-LIGHT COMPANY, LTD., "Incandescent lamps." April 4.
7213.—SCHUPPISSER, H., "Gas-regulators." April 5.
7229.—SHAW, E. J., "Inverted burners." April 5.
7236.—HIGGINSON, G., "Valves." April 5.
7241.—BAUER, C., "Gas-generating apparatus. A communication from the Güldner Motoren G. m. b. H. April 5.
7260.—LEDOUX, E., and SIMON-CARVES BYE-PRODUCT COKE-OVEN CONSTRUCTION COMPANY, LTD., "Change valve." April 6.
7264.—CHERLIN, A., "Incandescent burners." April 6.
7269.—STEVENSON, F. W., and WHITE, J. H., "Gas-lamps." April 6.
7281.—MATHER, C. J., and RIXON, A. R., "Joint-making packing for pipes, &c." April 6.
7287.—HAMPTON, J. C., and EMERY, F. O., "Gas-stoves." April 6.
7307.—WALL, J. W. R., "Manufacture of gas." April 6.
7310.—CAPITAINE, E., "Gas-producers." April 6.
7324.—CUTLER, S., "Gas-purifiers." April 6.
7328.—EMERY, J. & J., "Burners." April 7.
7402.—M'CREARY, E. H., and NIEMAN, G. A., "Water-meters." April 7.
7406.—WATKINSON, J. G., "Devices for holding the supports of incandescent mantles with the mantles upon them when removed from burners." April 7.
7428.—SMETHURST, W., "Burners for mixed gases." April 7.
7442.—BARTON, W., "Lighting lamps." April 8.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills brought from the Commons, read the first time, and referred to the Examiners: Birmingham Corporation Bill; Brentwood Gas Bill; Croydon Gas Bill; Great Berkhampstead Gas Bill; Hitchin and District Gas Bill; London Gas Bill; North Sussex Gas Bill; Otley Gas and Improvement Bill; Seaham Gas Bill; Sunderland and South Shields Water Bill.

Bills read a second time and committed: Accrington District Gas and Water Board Bill; Epping Gas Bill; Higham and Hundred of Hoo Water Bill; Loughborough Corporation Bill; Morley Corporation Bill; South Suburban Gas Bill; Wrexham Gas Bill.

Bills reported: Brompton, Chatham, Gillingham, and Rochester Water Bill; East Cowes Gas Bill; Walker and Wallsend Union Gas Bill.

Bills read the third time and passed: East Cowes Gas Bill; Truro Water Bill; Walker and Wallsend Union Gas Bill.

Bill Royal Assented; Leeds Corporation (Consolidated) Bill.

A Bill to confirm certain Provisional Orders made by the Board of Trade, under the Gas and Water Works Facilities Act, 1870, relating to Bolsover Gas, Denbigh Water, Formby Gas, Hayling Water, and Staveley Gas, was presented on Friday by Earl Waldegrave, read the first time, and referred to the Examiners.

HOUSE OF COMMONS.

Monday, April 10.

THE RATES IN LONDON.

Mr. BENN asked the First Lord of the Treasury whether, in view of the rise in the rates levied by the Borough Councils of London, especially in poorer districts, he would cause an inquiry to be held into the cause or need of this increase, and the possibility of further equalizing the burden over the whole of London.

Mr. BALFOUR replied that he was informed that the considerable rise in the rates which had taken place in the County of London was being inquired into by the Local Government Board. Legislation would be required to carry out the suggestion of the honourable gentleman.

Sir G. BARTLEY asked whether any steps would be taken, by legislation or otherwise, to prevent the enormous borrowing now going on.

Mr. BALFOUR: No, Sir; I do not think it would be possible by legislation to prevent that—at any rate, no scheme for preventing it has ever been brought to my notice. This, like other questions connected with local finance, must in the last resort be left to the good sense and discretion of the ratepayers. If they do not pay attention to their duties, no doubt not only considerable local, but also national, inconvenience will arise.

The following further progress has been made with Bills:—

Bills brought from the Lords, read the first time, and referred to the Examiners: East Cowes Gas Bill, Truro Water Bill.

Bill read a second time and committed: Tralee Urban District Council Bill.

Bills reported: Aylesbury Gas Bill, Halifax Corporation Bill, Heckmondwike Improvement Bill, South Oxfordshire Water and Gas Bill, Stockport Corporation Bill.

Bills read the third time and passed: Birmingham Corporation Bill, Brentwood Gas Bill, Croydon Gas Bill, Great Berkhampstead Gas Bill, Hitchin and District Gas Bill, London Gas Bill, North Sussex Gas Bill, Otley Gas and Improvement Bill, Seaham Gas Bill, Sunderland and South Shields Water Bill.

UNOPPOSED BILLS.

A Committee of the House of Commons, presided over by Mr. J. W. LOWTHER, dealt with several Unopposed Bills last Thursday.

Andover Lighting and Power.

The object of this Bill is to incorporate and confer powers upon the Andover Lighting and Power Company. The preamble sets forth that, owing to the increased demand for gas, it is expedient that the Company should be dissolved and reincorporated; that the gas-works should be extended and improved, and that additional capital should be provided for the purpose; that the Company should be empowered to accept the transfer of the Provisional Order authorizing the supply of electrical energy; and that they should purchase further lands to be used for the generation of electrical energy. The Board of Trade report on the Bill was adopted, and a clause was amended providing for 20 per cent. discount to large consumers. After formal evidence, the Bill was ordered to be reported.

Aylesbury Gas.

By the Aylesbury Gas Bill, it is proposed to incorporate and confer powers on the Aylesbury Gas Company. In the course of the formal evidence, it was stated that they had been supplying gas at 4s. 5d. per 1000 cubic feet, with 6d. discount; but they had agreed upon the figure of 3s. 11d. with the District Council. The Bill was ordered to be reported.

South Oxfordshire Gas and Water.

This Bill proposes to dissolve the present limited Company, and to re-incorporate it, extend the limits of supply, and raise additional capital. Formal evidence having been given, the Bill was ordered to be reported.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Second Day—Tuesday, April 11.

(*Before Mr. Justice* GRANTHAM.)

Graham, Morton, and Co., Limited v. Compagnie L'Union des Gaz. The Milan Gas-Works Contract.

The hearing of this case, commenced on the previous day (*ante* p. 111), was resumed this morning.

Mr. RUFUS ISAACS, K.C., Mr. J. A. SIMON, and Mr. A. M. PADDON (instructed by Messrs. Spyer and Sons) appeared for the plaintiffs; Mr. J. A. HAMILTON, K.C., and Mr. A. H. SPOKES (instructed by Messrs. Waterhouse and Co.) represented the defendants.

TWO IMPORTANT REPORTS.

Mr. ISAACS, continuing his address for the plaintiffs, read the report made by Mr. Green, the defendants' own Engineer, in which he said:

I have read Mr. Bourne's report, and find it in agreement with the reasons he gave me when I was last at Milan speaking to him about carrying out the recommendations of the Paris Directors. I see no reason to doubt the correctness of Mr. Bourne's statement, nor do I believe the action of the men in charge of the oven has anything to do with the want of temperature complained of. It will be noted that the last paragraph in Mr. Bourne's report states that wet coal was being carbonized, the charges of 314 kilos. containing 9 per cent. of water. This is sometimes inevitable, because most of our coal must be stored in the open. At the same time such charges are particularly bad for inclined retorts, because the wet coal lies in the storage bunkers and neither drains nor dries. This is quite different with hand-charged horizontal retorts, because with them the wet coal is laid on the retort-house floor, where it drains and dries fairly well before being placed in the retorts. Putting aside structural faults which prevent the gas and secondary air nostrils from being properly cleaned out, and also the low make of gas per ton of coal carbonized, there is a question I should like Milan to answer. Taking the last retort return—that for October—I find that a Graham oven of nine 20-feet inclined retorts carbonized in 24 hours 9059 kilos. of coal, and produced 2513 cubic metres of gas; that a Stettin oven of nine 15-feet retorts carbonized 6383 kilos., and produced 1768 cubic metres of gas; the production per 1000 kilos. being the same in both cases—viz., 277 cubic metres. Now, as the sections of retorts are about alike in capacity,* why is it that if the Graham ovens are complained of, we do not complain of the Stettin ovens? I have worked out the figures, and find that, taking the Graham's at 9059 kilos., the Stettin ought to carbonize 6794 kilos., and so are 411 kilos. short per oven on a *pro ratâ* basis with ovens we are not satisfied with. Now, are the Stettin ovens also defective? Is it found impossible to work them at high temperature? If so, what is the reason? Will Milan kindly say? I have gone into this matter because I believe the Board will be glad to have the facts before them. The practical advantage of 20 feet over 15 feet inclined retorts is demonstrated at Milan in a saving of labour of one lire per 1000 kilos. of coal carbonized; and if we could carbonize more thoroughly, we should have nothing to complain of. But this defect would appear to be common to both the Graham and the Stettin ovens. We shall hear definitely in a few days about this.

This, said the learned Counsel, was a very useful report, as it dealt in full with the facts. Mr. Green was sent out by the defendants, and arrived at Milan on Nov. 27, 1902. He said in his report that he saw the Manager, Mr. Bourne, who confirmed the statement as to the friction which existed at the works between the Italian workmen and the plaintiffs' employees. There was an unofficial test of the installation, which was stopped, and the official test began on the 17th of November, and ran for ten days. From Mr. Bourne, he learned that the Graham inclined retorts were working, but not satisfactorily, and that great friction existed. He told them they must not force the heats, and that such an immense mass of brickwork required very careful heating before any forcing would be safe. He found the friction such that the men were continually raising minor objections. He tried to smooth matters down between the two sides; but this was very difficult. Mr. Bourne had to supply a great quantity of gas, and he was so short of power that he had to interfere with the tests arranged. At midnight on Friday the 7th of November, he had ordered five charges to be put into the retorts, whereas the maximum was only four. This was excusable, because the gas was getting low owing to dull days. But instead of leaving the charges in the retorts to thoroughly carbonize them, they were withdrawn after a certain time, which was very detrimental, as by this means the heat was reduced. Mr. Green went on to say that this method of dealing with the installation was like running a train at full speed with the brakes on, and that he found the production of gas low, and the heat bad. He said he had pointed out the ruinous nature of this kind of working, and so they must arrange matters better. Mr. Bourne had replied that, in consequence of the Company being compelled to make the fullest possible use of the benches, in order to keep up the supply of gas, they had to use larger quantities of coal than were justified. Certain changes were made, and Mr. Green remarked that watchmen had to be provided to see that things were not tampered with at night. At the end of his report he said: "The installation is good, solid, well designed, and built of the best material." The importance of this report could not be exaggerated, because it was made by the defendants' own Engineer, who went out to Milan to examine the installation to see whether the tests must be gone on with or could be dispensed with. On Nov. 29, 1902, a letter came from Mr. Leech, the plaintiffs' Engineer, in which he said: "I am pleased to inform you the settings are now in perfect working order; the charges are perfectly carbonized, and Mr. Bourne is highly pleased." After that date Mr. Corbet Woodall was sent out by the defendants, and in his report he said: "It seems to me that the master's control was conspicuous by its absence." This, he said, was due to the large amount of work still under construction.

Justice GRANTHAM: That is an attack on Mr. Bourne.

Mr. ISAACS said that was so, to a certain extent. Mr. Woodall also reported that the retorts and benches erected by the plaintiffs "seemed to be of excellent construction." He added that everything was in a satisfactory condition, and that in view of the pressure for gas he advised them to discontinue the tests till March, 1903. He said: "The work is now much more satisfactory, and Mr. Bourne is content with the working." There was a portion of the report which was only disclosed to the plaintiffs at the last moment, and which really put the defendants out of Court on the point he was now dealing with. Mr. Woodall, in his report, said: "Mr. Bourne is, in my opinion, a thoroughly devoted officer; but it is clear to me he attempts too much. He says his Chief Assistant is of little value to him. I feel sure Mr. Bourne has been cowed by the workmen, and is afraid to assert himself to get the proper performance of the necessary duties. It is essential there should be a new chief or that Mr. Bourne should have assistance." He (Counsel) said this report of defendants' own expert established the point he was seeking to make—viz., that one of the great difficulties was the staff, and that Mr. Bourne had not proper control of his staff; and the consequence was he could not get his men to do their work properly. It was then suggested that the final tests should be put off till March, 1903, but plaintiffs declined; and it was quite plain that, whenever the test was made, defendants were to take over the whole responsibility, and that plaintiffs were relieved from any further responsibilty except as regarded the time guarantee. In December, Mr. Green examined the whole of the benches, and recommended that they be accepted as carrying out the terms of the contract; and on Dec. 16, £20,000 was paid by defendants to plaintiffs, which was only payable after the tests had been made. He submitted that this showed conclusively that the defendants had accepted the installation without any further test, and that all that remained was the time guarantee, and that the defendants were not entitled to complain of anything but this. If this was so, seven-eighths of the particulars of the action would disappear. It was also an undisputed fact that two sums of £1000 each, which had been held over under the December agreement (and which were to be held over till March, 1903), were then paid over to the plaintiffs without demur. Then, later on (in March, 1904), Mr. Bourne, with the object of saving labour, set to work to demolish the 32 furnaces without any communication to the plaintiffs—a fact which they did not discover till 1904, when the difficulty arose between the parties, when plaintiffs called on defendants to pay the last part of the retention money becoming due. It was only just before this that Mr. Bourne had commenced to demolish the benches; he having said he was dissatisfied with the working. Upon the difficulty arising, Mr. Graham, Mr. Morton, Mr. Herring, of Edinburgh, Mr. Hulse, of Leeds, and others, went and examined the installation; and the sum and substance of their examination was that no doubt they found some fluxing which had been caused by direct heating. This meant that the defendants had not properly worked the furnaces. If they used the finest installation ever made in this way, it would be spoiled in from 24 to 48 hours. The main thing the defendants complained of was this fluxing, and all the experts would tell his Lordship that they thought there were no words to describe the absurdity of working a plant in this way. The cause of the whole thing having happened was the defendants continuing to use wet coal, and the fact that they were not paying proper attention to the draughts. They did not seem to know how to use the dampers; and if there was any difficulty, as defendants said, with the nozzles, this was due to want of cleaning.

Justice GRANTHAM: What did they do when they pulled down your furnaces?

Mr. ISAACS said they put up some French furnaces; but they used the inclined retorts. It was a remarkable thing that this set of inclined retorts provided by plaintiffs was the only set of such retorts which had not been successful. He submitted that, if he made out that any fault of the installation was due to the defendants' improper working, the defendants case must fall to the ground.

MR. GRAHAM'S EXAMINATION-IN-CHIEF.

Mr. *Maurice Graham*, the Managing-Director of the plaintiff Company, said he had special supervision of the installation in question. He had been a great deal associated with the construction of inclined retorts; and he had specially devoted himself to gas engineering. At the end of 1901, plaintiff went to Milan to see the defendants' works, and arranged to send detailed drawings to them of a proposed gas installation. The first proposal was for 16 beds; and this formed eventually Contract No. 1. Mr. Green visited the plaintiff in Edinburgh the next year, and saw the installation there. Eventually the contract was signed on Jan. 13, 1902, and a staff was organized and sent out. Mr. Leech was the Resident Engineer, Mr. Tranfield was the superintendent furnace builder, Mr. Jeffreys was the clerk of the works, and Mr. Davies the superintendent mechanic. There were also two clerks as cashiers and 20 English bricklayers and retort-setters, as well as from 16 to 20 mechanics. All these people were sent out specially for this work, and witness also paid 16 visits to Milan during its progress. Mr. Bourne, the defendants' Engineer, was in charge of them; there was a man named Blow, but he was not worth much; and the rest were Italians. There was a Frenchman named Solanges; but he was merely the secretary and cashier. All the men sent out had had great experience in these matters. Mr. Green inspected the materials at Leeds before they were sent to Milan, and none of them were ever rejected. Every one of the drawings was submitted to the defendants, and approved by them; and in one or two cases modifications were made at Mr. Green's suggestion. The works were carried out exactly according to the designs. The defendants suggested that Italian bricks should be used in the foundation; and Mr. Himing asked witness to buy as much of the material as possible in Italy. This he did. The defendants had to pay duty on all materials taken into the country. The bricks, tiles, fire-bricks for the main flues, and red bricks for filling in, were all purchased in Italy. When the goods were bought in Italy, Mr. Bourne gave the orders; and

* Mr. Green gave sketches and the average dimensions of the retorts, and also the following particulars: Stettin retorts, 15 feet long; actual charges, 196 kilos.; guaranteed 280 kilos. every six hours. Graham retorts, 20 feet long; actual charge, 286 kilos.; guaranteed charge, 300 kilos. every six hours.

if he was satisfied with them, this was enough for plaintiffs. In this case they were always inspected by the defendants' servants at Milan. Mr. Bourne was present on the site during the whole of the construction. It was not true that red bricks were used where they ought not to have been in the building of the flues. Those used were Morningside fire-bricks from Glasgow and from Lachomette of Lyons. He examined the bricks after the flues were partially pulled down, and therefore was perfectly sure on this point. There were special locks put on the temporary air boxes, to prevent the stokers tampering with the slides; but they were stolen and replaced three times. On Sept. 1, 1902, the whole of Contract No. 1 was fully completed; and then the gradual drying of the brickwork began. If this was not done slowly, they would get contractions; and if they used heat, it would be dangerous. Witness went in October to Milan, when the benches were first charged for gas making. Defendants were then using coal which was of the consistency of mud or wet sand, and when drawn up in the elevator bucket it stuck to the bucket, and would not drop out. This kind of thing interfered with the work. The contract particularly specified that dry coal should be used, as wet coal prevented the carbonizing and produced less gas. If it was taken out (as it was in this case) at the end of six hours, and then more wet coal put in, this made matters worse. On Oct. 14, witness saw Mr. Himing, in Paris, about the tests, and some were begun on Oct. 16. At this time there was correspondence about the way the workmen closed the mouthpiece-lids. Instead of closing them with a wooden mallet, they used a bar of iron, and this broke them off. The tests commenced on Oct. 16 went on till Nov. 8, and then were stopped; Mr. Bourne changing the charges from four to five per 24 hours. The usual practice when the valves were opened was to clean the doors of the tar and other substances, so as to get a tight joint; but the workmen would not do this, and in many cases they could not shut the doors at all, which prevented proper distillation. The stokers were also very lax in regard to opening the doors of the retorts, and the result was that there were many explosions, which shook and injured the settings. The official tests began on the 17th of November, and witness arrived at Milan two days before that date. He met Mr. Green at Milan, and one bed of retorts was put under test each day. Witness only remained for seven or eight days, but the 16 beds would require 16 days for testing. Every charge, before being put in the retort, was weighed with the assistance of the defendants' representative; and the hot coke which was put into the producers was also weighed while hot. Mr. Leech and Mr. Tranfield were present for the plaintiffs during the test; and Fumagalli, the retort-house superintendent, and Chiesa, the foreman, represented the defendants. [Test sheets, with results, were handed to his Lordship.] The tests ran from Nov. 17 to Dec. 3, and the result averaged about 312 kilos of coal carbonized; the guarantee being 300 kilos. The fuel used came to about 13 per cent.; while the contract allowed 15 per cent. In the last three days, the charges were five instead of four in 24 hours. On the first day witness was there, he had to complain of the conduct of Fumagalli. Before putting the hot coke into the furnace, witness saw this man throw water on to it, which lowered the heat; and he complained of it. He saw Mr. Bourne on the subject. He next found that Fumagalli was changing the stokers; and he also complained that the furnaces and the clinker were poked while the charging was going on. Mr. Corbet Woodall went to Milan after witness left; and it was then suggested that the tests should be postponed till March. Mr. Woodall told witness that the workmanship of the installation was perfectly satisfactory, but that the heats were not good when he saw it. This was explained by the fact that the furnaces were being worked at pressure in order to get a certain quantity of gas. Witness saw Mr. Himing on the 4th of December, and told him that plaintiffs could not consent to the tests being postponed till the following March. It was then suggested that if the benches were taken over, £1000 should be retained till the spring; and this was agreed to. Mr. Green was sent out at this time to see the position of affairs, and he telegraphed: "After inspection, I recommend that the four Graham benches be accepted, and no further tests of them be made, so far as the contract is concerned." The next day defendants sent plaintiffs £20,000 due. Witness then asked Mr. Himing for a formal certificate, according to the specification; but he replied that the cheque for the money was the best certificate he (witness) could have. There were other contracts for the coke-conveying plant to be concluded; and Leech and others stayed in Milan to finish it. Witness heard there was still trouble in Milan with the stokers, who tried to wreck the plant; and witness had an interview with Mr. Lucas, the Chairman of the London Committee of the defendant Company, and on Jan. 13 he and Mr. Leech, who had been brought from Milan for the purpose, were present at an interview with the Directors. Witness explained the bad working of the men and the bad management at the gas-works generally. Eventually Mr. Lucas said the Board had considered the matter, and thought it would be better to take the plant over, and work it with their own men; and in consideration of this, they asked witness to allow £400 for any little work that had to be done on the coke-conveying plant. This contract was the only one that was then running. Witness accepted the suggestion in the room, and a letter followed confirming the arrangement. Witness's men were then brought back from Milan, with their tools and materials; and from that time Mr. Bourne and his people, and not witness, had charge of the installation. The arrangement was that the two sums of £1000 which had been agreed to be left over should be paid in March, and a general payment of £10,000 was then made; the only amount left being the time guarantee of £2000 on each contract. There was no correspondence between the parties from March, 1903, till the 1st of December, and then witness heard complaints of the installation. This was when it was found that defendants had altered the construction of the furnaces; the grate-bar area being reduced in space. The defendants were then only clinkering the furnaces once in 48 hours instead of once in 12 hours as they should have been. Then, instead of picking out the coke from the clinker, and using it again, the whole was sold for 4 frs. a ton. Witness paid a visit to Milan in April, 1904, and found out these things himself. Carbon was also allowed to collect in a very thick coating on the retorts, which, besides preventing the heat getting into the coal, affected the illuminating power of the resulting gas. There was no pressure-gauge in the retort-house when he visited it; and without one it was impossible to carry on the delicate operation of gas making. At witness's visit in April, Mr. Marshall was there on behalf of the defendants, and he said everything was satisfactory in regard to the construction of the settings. When the defendants pulled them down, it was a pleasure to him (witness) to see how well they had been built. It was as much as the Italian workmen could do to break down the walls with crowbars 2 inches thick. There were signs of fluxing, which showed that the fuel in the furnaces had been kept too low. Witness went to Milan again in May with Mr. Hunt, Mr. Shoubridge, and Mr. Herring—all experts; and he then found that defendants were using a little better coal than before. They examined the furnaces, and concluded that the fluxing was caused by direct firing. The cost of carbonizing by the Graham system was 1s. 4½d. per metric ton, and by that of the Stettiner Company 2s. 3d.

Third Day—Wednesday, April 12.

On the hearing being resumed to-day,

Mr. *Graham*, continuing his evidence, produced a large piece of carbon taken out of the defendants' retorts after working, and said that if the furnaces were properly worked they would never get carbon in them of this size. The carbon was taken out in May last year, 18 months after defendants had begun work. This formation was caused by back-pressure; and if the installation was worked properly the carbon would have remained in a gaseous form, and would have added to the illuminating power of the gas. The other bad result was that this carbon adhering to the retort kept out the heat. To prevent this deposit, the retort-lids were kept open, air was allowed to enter, and the carbon was also scraped off.

Mr. Graham's Cross-Examination.

Cross-examined by Mr. Hamilton, K.C., witness said he was the author of a book on the methods of working gas-furnaces, and, of course, his customers expected he should be an expert on the subject. He had never been the manager of a gas-works, but he had served his time to a gas-apparatus maker. He had never been responsible, as a gas manager, for the production of gas. He was not a graduate of any technical school or university, but he took about fifteen certificates on various scientific subjects at South Kensington. He regarded the work at Milan as a record in construction; but he did not utilize the drawings of the Edinburgh works to save time. The inclined-retort system in use at Edinburgh was that employed at Milan. The Edinburgh system was the latest at that time; and when he undertook the Milan work, Mr. Green came to see witness and the Engineer, and discussed the drawings for Milan. It was never suggested that the installation should be the same as the one at Edinburgh, because the circumstances of the two works were absolutely different.

Justice Grantham here asked if it was necessary to keep such a large number of witnesses as were present in Court.

A Proposal for an Inquiry.

Mr. Hamilton said a great part of the case was obviously one specially suitable for the inquiry of a person of scientific training; and it might suit his Lordship that all technical questions should be referred to a scientific gentleman to investigate and report, and then all questions of law and deductions from his conclusions would come back to his Lordship. He could not conceal from himself that it was making a great claim on his Lordship's public time and personal attention to deal with a case like the one before him, which it was impossible to conduct without considerable reference to plans and calculations. The defendants had a number of witnesses who had been to Milan at the same time as Mr. Graham, and their evidence was diametrically opposed to what had been opened. In his view, it was impossible to make a short cut in the case.

Mr. Graham further Cross-Examined.

In further cross-examination, witness said that to do the work properly and economically, the heat should be applied as evenly as possible. The heat necessary to carbonize coal was obtained by the combustion of carbon monoxide, and this was effected by allowing ordinary air to be conveyed to it. It was more even and did more work by warming it.

Justice Grantham (to Mr. Hamilton): You sent your Engineer to see the working of this scheme, and you agreed upon it. Having accepted the principle, the only question is whether the plaintiffs carried it out.

Mr. Hamilton said he was putting questions to the witness to show how he was going to direct his evidence to matters of fact. The defendants were at issue with Mr. Graham as to Mr. Green accepting the plans, and they could not agree that he saw certain plans.

Cross-examination continued: Mr. Green came to Edinburgh on either Jan. 9 or 10, 1902, and witness showed him half-a-dozen plans of the hydraulic mains, the furnaces, and other things. These were the exact drawings on which the Milan works were erected; and he made them himself. He did not recollect what other drawings were shown, as the interview lasted a day or a day-and-a-half; and thousands of drawings passed through his hands.

In reply to his Lordship, Mr. Hamilton said his case was that neither Mr. Green nor any official of defendants saw any drawings of the internal arrangements till after the ovens were built.

Justice Grantham: Well, Mr. Graham says you did.

Witness further said Mr. Bourne discussed the plans and drawings with him at Milan when the furnaces were built. He laid before Mr. Green, on Jan. 1, 1902, plans which showed the carbon monoxide ducts, the passages round the retorts, and the regenerator. After the defendants took over the works, he paid little attention to what they were doing; and he was not aware, till he examined them in 1904, of the details of the alterations made by Mr. Bourne. He denied that in April, 1903, a full plan of the alterations was shown to him, and that he approved of it. This did not occur, to his knowledge. He certainly did not see it in July, 1903. Of course, it was most important that all the brickwork in a construction like that in question should be of the

very best quality. He did not remember that Mr. Herring had complained to him of Tranfield's carelessness in building the brickwork of the Edinburgh installation, nor did he find Tranfield neglecting the cleaning out of the flues at Milan. He saw the men demolishing the ovens in bench No. 6 in October, 1904; but did not see the whole of the work done.

THE UNSPOKEN EVIDENCE OF PHOTOGRAPHS.

Mr. HAMILTON here produced a number of photographs of the furnaces at Milan in course of demolition. He pointed out in one part a brick which had dropped and been fused in working, and said this had not been done in demolition. He suggested that the division wall at the back was badly built, because the bricks were set on end, and there was no crossing of the joints to prevent the gas entering.

Witness said it did not matter whether the gas entered or not, as the wall was simply a support for the retorts. Of course, it mattered whether or not the wall slipped and fell; but he wished to point out that the photographs were taken after the Italian workmen had been at the walls with crowbars and hammers. The ovens had also been in use for a considerable time. If they took a photograph of a new work which had never been fired, but knocked about as this one had been, it would present a very similar appearance to that shown in the photograph.

Mr. HAMILTON produced a photograph of another part of the ovens in which he said the brickwork had been fused and the molten brick had run all over the apertures.

Witness said this was his case. It was the result of direct firing by the defendants' men. They had not put enough coke into the furnace below, and consequently they got direct flame from the producer which had fluxed the places complained of. In answer to further questions, he said the bricks would fuse as they had done, even after the flames had been licked up the full distance of the passages—some 12 feet—when they got into the combustion chamber. The object of his design was to get even heat distribution throughout the whole of the inclined retorts; and if the stoking was not properly done, as he alleged, this end would not be attained. He admitted that, if Tranfield did not carry out his plans, he did wrong. Generally the nostril holes became diminished as they got up the combustion chamber; and if they were not so, there must have been some reason for it.

DEFENDANTS' OBJECTIONS TO THE SETTINGS.

Mr. HAMILTON: We say that, owing to the construction of your furnaces and ovens, too much heat was drawn into these chambers [indicating them on the photograph], because an excessive draught went through the passages, and because, owing to the design, they got more carbon monoxide than the other combustion chambers did. I say that, owing to the position of your duct, more carbon monoxide went into the bottom chamber of the upper half than into the lower half, and there was more draught; and therefore if they got enough draught to heat the upper chambers, the others became excessively heated, and fluxed the bricks.

Witness: I follow; but ——

Mr. HAMILTON: But you think it is all rubbish.

Witness: I say that if they got too much draught it was their own fault, because they controlled the draughts themselves by means of the dampers.

Witness was then cross-examined in detail, by the assistance of the photographs, as to the use of the dampers. He said it was essential, in the construction of a regenerator, that there should be no means by which passages through the division wall might arise, and let cold air pass into the exhaust flue. It was of the utmost importance that the wall should be impermeable to the air; and for this purpose they must have the most perfect jointing that could be got. If Tranfield left the walls so that cold air could get through, it would no doubt be very bad. He thought that the weight of the whole setting above would keep the joints tight. The regenerator at Milan was not intended to be like that at Edinburgh. He varied it, as he thought the variation was an improvement on the Edinburgh one.

In answer to his Lordship, Mr. HAMILTON said a part of his case was that this variation was not successful, and that the defendants did not agree to it, and, in fact, knew nothing about it. His experts would say that this regenerator was inherently vicious; and he should submit that the guarantee expressed in the contract had not been performed. The proof of this rested on the conflicting evidence of experts, who alone were able to judge.

In further cross-examination, witness said the fuel account would prove which was the best generator. But his view was that the variation he made in the Milan generator was an improvement. He admitted that it was smaller than that in the Edinburgh works; but he said it was quite large enough, and one of the same size was now working well at Leeds. In the Milan division walls, notched bricks were inserted, which had the effect of keeping the whole wall solid; and where these were left out, it was for the purpose of bonding the wall. Where this was done, there was a straight line through the wall; and there they had to rely on the mortar to prevent leakage. There was quite sufficient bonding to prevent leaks in that way. He never saw in the Milan works any bye-passing, which would show leakage through the division wall. The contraction and expansion of the brick walls, owing to the raising and lowering of the furnace heat, need not occur to any dangerous extent if the heat was lowered and raised slowly and carefully.

Mr. HAMILTON said he submitted that the plaintiffs so built this installation that it was impossible to work it satisfactorily except by putting on an amount by draught which produced the fusing and fluxing complained of.

Justice GRANTHAM: Well, he says that is not so.

Mr. HAMILTON: But my witnesses will say that it is.

Justice GRANTHAM: Well, let them do so; but you cannot go over and over again into these details.

Cross-examination continued: One of Mr. Bourne's mistakes in altering the furnaces was to restrict the grate surface by reducing it by half; and he also did wrong by letting the fuel rest on the bottom of the furnace. This was a Continental system; but he had never worked it. The whole of the original pencil drawings of the plans, &c., had been destroyed in November, 1903, when the plaintiffs' firm moved into their new large works, and adopted the American system of using tracings only, from which blue prints could be produced.

A SUGGESTION FROM THE JUDGE.

Just before the rising of the Court,

Justice GRANTHAM said he thought, when the cross-examination of the plaintiff was concluded, he would hear what Counsel had to say on the point of whether the defendants could go behind the question of the tests, as this might affect the future conduct of the case. So far as he could see, the defendants' case appeared to be fighting French experts against English.

Mr. HAMILTON said nearly all his experts were English ones, and their objection was to the way in which Mr. Graham had carried out the work.

Justice GRANTHAM said if they had no right to go into all these questions, it would be much better to have the legal argument first as to the way in which the matter stood.

Mr. HAMILTON said he had carefully considered the matter, and he did not see how justice was to be done to his clients if the evidence of the experts was excluded, even if his Lordship took the view, as opened by Mr. Isaacs, that the acceptance of the works, even without the full tests, was an acceptance in the terms of the contract. The defendants' case was that even if they accepted the installation, they could sue on some of the guarantees. Mr. Graham said the whole damage was done by the way in which defendants' men worked; and the proof of this would be in what the experts discovered after the demolition of the furnaces. He submitted he was entitled to give this evidence anyhow, to show that Mr. Graham was wrong.

Justice GRANTHAM: Then what part of the case can be referred?

Mr. HAMILTON said he thought the technical evidence of the experts which dealt with the defective state of the machines could be referred; and it could then come back to his Lordship to decide what rights defendants had.

Mr. ISAACS said he had never wished any part of the case to be referred. He felt that, after his clients had gone to considerable expense to get experts in attendance, it would be a great hardship if the case was referred.

Justice GRANTHAM remarked that he had never referred a case in the course of twenty years, except by consent of both parties.

Mr. ISAACS said he felt that when his Lordship had dealt with the broad point of the taking over of the installation, it would have disposed of seven-eighths of the case; and all that would remain was the question as to whether the various guarantees which were given had been performed.

Fourth Day—Thursday, April 13.

When the case was resumed to-day,

Mr. *Graham* was further cross-examined by Mr. HAMILTON. He explained a table of the returns of gas made by the Milan works in the first three months of 1903, which he said was compiled from figures furnished by defendants books. But he admitted that, besides his own installation which was at work there, there was another which was called the Stettin; and as the gas from each went through the same pipes, he had taken half of the total quantity produced for each installation. He took the figure of 272 cubic metres of gas for each metric ton of 1000 kilos of coal.

In answer to his LORDSHIP, witness said the whole of the gas went through the same pipes to the same meter, so that it was impossible to tell how much each installation actually produced.

Justice GRANTHAM: If your installation was better than theirs, as you say, and it carbonizes more coal per bed in a given time than the figure taken, that figure would not be a common factor, but it ought to be more for yours and less for theirs?

Witness: Yes, absolutely.

Putting it the way you have done, that gives them an advantage?—Yes.

Mr. HAMILTON: Are you aware that during 1903, owing to an error in calculation at Milan, the coal in fact used was under-estimated?

Witness: I have had no report or letter to that effect, though I have heard a rumour of the kind. Of course, I made no allowance for anything of that sort.

Now as to the tests. The point you make is that, although they only ran for a limited time, they were evidence as to the excellency of your installation?—Yes.

Do you say the tests were materially affected by the wetness of the coal?—Yes.

Well, I have been through the test-sheets signed by Leech and Tranfield. There are 20 sheets of the first set of tests, and each sheet is made out on a form which allows of full details. Out of 20 sheets, on 16 days the coal is recorded as being dry; on one it is medium; in three only it is "damp;" and in none is it wet. In the second sixteen, there are only four in which it is anything like wet. Do you agree with the reports?—They are made by Leech and Tranfield.

THE ATTITUDE OF THE ITALIAN WORKMEN.

In further cross-examination, witness said the Stettin installation was on the same principle as his. He knew that there was great difficulty with the Italian workmen, who did not like the English machinery. There was a man named Chiesa who did not do what he was told. No doubt he did not understand a word of English; but they always had an interpreter there. Another Italian (Fumagalli) was a difficulty in the working. He did not suggest that Mr. Bourne did permanent harm to the brickwork of the installation by his putting five charges in the retorts instead of four; but it certainly interfered with the tests. The charge with regard to which the plaintiffs gave the guarantee was 300 cubic metres of gas from 1000 kilogrammes of coal; but this could be increased according to the quality of the coal and other circumstances. The large lumps of carbon produced in Court were taken from the top of the retorts. The fact of the carbon being there was a proof that the gas could not be what it should be. The carbon, in

fact, was the gas. If they got high heats up against the carbon, the retort would be damaged. When the carbon was formed, it was taken out; and then the retort was all right. The fact of the existence of the carbon would affect the value of the gas; but it would not affect the structure of an installation.

Justice GRANTHAM: You say in your "particulars" that damages were caused by explosions?

Mr. HAMILTON: Yes. It was also said that one of the English workmen caused damage by firing a revolver in the nozzle of the duct?

Witness: Well, you can ask the man who did it how it happened.

It seems a pity to carry revolvers and not let them off?—Oh, we should have let them off if necessary. We had two or three bricklayers knifed; and then we all carried revolvers.

Then you were on bad terms with your own Italian workmen, and that caused the stabbing?—Oh, not till the men were discharged.

Re-examined by Mr. SIMON: Whatever the consumption of coal really was, of which there was no record, the figures he had compiled were taken from Mr. Bourne's returns. The dislike of the Italian workmen was principally to the machinery and specially to the coke-conveying plant. The explosions of gas which were caused by the men's carelessness shook the whole of the brickwork. His system of inclined retorts was a labour-saving arrangement, which accounted for the feeling of the workmen, as it reduced the number of men employed. His complaint as to Fumagalli was as to his working of the retorts in November during the tests. When the hot coke was weighed and put in the furnace, Fumagalli threw water on it, which was injurious to the working. This action took away an advantage of the use of hot coke which was very essential. Then, again, as soon as they had instructed the Italian workmen in the duties, Fumagalli would take them away, and they had to begin again with strangers. Witness started the tests himself and saw wet coal used on several occasions, though in his contract he stipulated for dry coal. Even with these drawbacks, he obtained a result of 13 per cent. of fuel used where he might have used 15 per cent. There was a quantity of carbon taken from the retorts as well as the piece produced; but if the works had been well handled there ought to have been no such carbon as this.

Mr. SIMON: Wherever you have been in gas-works have you ever seen such a piece before?

Witness: No; this is a curiosity.

[The piece of carbon referred to was about 3 feet long and over 20 inches wide.]

In answer to further questions, witness said he had now found the clerk who made the tracing from the pencil plans which witness drew on Jan. 8, 1903, and all were shown to Mr. Green as he had stated. Mr. Herring, the Engineer at Edinburgh, was present at the interview when he showed the original drawing to Mr. Green. His furnaces were designed to work as a whole, and if the installation was changed so as to work on the Continental system, as Mr. Bourne had altered it, the furnaces should have been extended laterally, and this was not done. Having again explained the cause of the "fluxing" of the brickwork, witness said the work at Milan was exactly on the same plan as installations which were being worked most successfully at Leeds and elsewhere. He had made a careful estimate of all that would need to be spent per bed of the installation to put right anything that was now complained of; and he reckoned that £18 per bed would cover the cost. He then went in detail through the "particulars" of the alleged defects supplied by the defendants, to prove that they could all be put right for the sum named.

ADDITIONAL EVIDENCE FOR THE PLAINTIFFS.

Mr. *Lancaster* was next called, and said he remembered particularly having to make tracings from Mr. Graham's original plan, which was shown to Mr. Green. This drawing included the whole of the furnaces, the regenerators, the retorts, and the entire thing. It was the same as was supplied in all cases, and he should say was sufficient from which to erect the works.

Mr. *W. B. Leech* said that he had had considerable experience as a draughtsman and in connection with the erection of engineering works. He had been in plaintiffs' service for many years, and looked after the erection of the Edinburgh works. He was also at Nanterre, where works were put up by the plaintiffs. He was Resident Engineer for the Milan works, and went out in January, 1902, remaining there till the work was completed and the plaintiffs' people left. The whole of the work was done satisfactorily, and in accordance with the plans. Mr. Bourne was the Resident Engineer for defendants, and visited and inspected the work daily; sometimes making modifications in the plans, which were adopted. It was not true that common red brick was used in the lining of the flues. This was done with fire-brick—"Morningside" bricks, which turned red after heat. When the installation was first started, it was an excellent structure, and ought to have worked well. The coal given out to be used was very wet; but witness insisted on dry coal for the tests. The tracing spoken of by the last witness was that from which he worked. In the preliminary tests, the workmen allowed the heat to go down at night, which reduced the results; and in the course of erection they had opposition from the workmen at almost every point. The removal of clinker was not done often enough. He complained that it was only done every 48 hours; but Mr. Bourne said he thought it was done every 16 hours. Clinkering was very heavy work, and the men did not like it. On the 4th of November they found great back-pressure on the retorts; and after search they discovered that the valve of the foul main was practically closed, and therefore the gas could not get away into the purifiers. The valve main was supplied and worked by the defendants. In November, 1902, Mr. Corbet Woodall went to Milan to inspect the installation for the defendants, and he told witness it was the finest he had ever seen. Mr. Green subsequently went out and inspected the works, and told witness he should recommend the defendants to take them over. Witness went to Milan to see the demolition of the furnaces, and the result showed fluxing caused by direct firing. The construction, as a whole, was perfectly good. He noticed that the defendants' men used the dampers irregularly and improperly; and this was what caused the direct firing. One of defendants' men—Mr. Blow—told witness in August, 1902, that he could not get the men to fill and work the producers properly.

In cross-examination by Mr. SPOKES, witness said he did not see the whole of the benches demolished in 1904. He could not say there was anything to show that they had been damaged by the explosions referred to. He admitted that by the 26th of November only nine beds out of the sixteen had been tested, and that it had been suggested that the defendants should take over the works then. He supposed this was done under instructions from the plaintiffs' firm. He denied that common red bricks were used for the flues; they were only employed for the filling in, and this was a common practice. He said that the furnaces were properly bonded, and this was the case all over the works. It was quite correct to use arch bricks in the construction of the transverse walls, and, in fact, he considered this rather an improvement than otherwise. He denied that these had fallen out and choked the gas passages; but in some places, where the direct firing had fused the bricks, they had become agglomerated into one mass of melted silica. He believed that they had used the common red bricks for filling in the duct over the furnace in Edinburgh the same as in Milan. It was quite a common practice to do this, as it was not expected that in this part of the building there would be very great heat. There were no strangled joints; but he had no doubt there were cracks in the wall, as this was a common feature in furnaces. The brickwork was tied in every four courses, which was quite sufficient. He admitted that some of the arches had sagged two or three inches, but this was a very usual thing in such works, owing to the heat. There were no cracks in the division walls; and he examined them very carefully after the demolition. Witness had nothing to do with the design of the furnace; and he did not know that exactly the same design was used as at Edinburgh. He only saw that the work of building was properly carried out. The heat was not more intense in the lower chamber than in those above. When he was there, he saw that the heats were very even in all the chambers. He believed the lump of carbon in Court formed in the roof of one of the retorts. There was a great amount of carbon in all the retorts he saw; but he could not say there were stripes in the retorts which showed uneven heating, as he was not a chemist. He did not know that Mr. Corbet Woodall looked inside the regenerators when he visited the works; nor did he think Mr. Woodall said the construction was good, so far as he had seen, but that he did not approve of the heats. Witness was present in Milan in August, and saw Mr. Blow there. On the 18th he made a note that the Stettin furnaces were shut down. He also directed Mr. Blow's attention to the fact that the producers were nearly empty; and he called the foreman and warned him that this must not be allowed.

Mr. SPOKES: Did not Mr. Marshall and Mr. Blow ask you to look into the retorts and see the stripes which indicated unequal heating?

Witness: I saw it was a little whiter in one place than in the other, but I did not attach much importance to that.

Re-examined: Mr. Bourne himself suggested a change in the design of the dampers, which the plaintiffs adopted. The ordinary course was that Mr. Bourne should see all the plans and approve them; and he did so. When he saw the demolition, he was very pleased to notice that such good work had been put in the installation. The way in which he saw the installation worked would explain anything which was wrong in the results.

John Tranfield said he was a bricklayer and retort-setter, and had been with plaintiffs' firm about nine or ten years. He had done his work under Mr. Graham's instructions and training. He went out to Milan as an expert to do the work, and had a gang of qualified men under him. The bricklaying work was done properly, and as good as ever hands could make it. His attention was specially called to the necessity of keeping the passages of the flues clear. He saw a little of the work pulled down, and all the damage he noticed was caused by direct firing. It was not true that common red bricks were used for the face of the flues. They were only used for filling in.

Mr. SIMON: You were said to have fired a revolver into the nostrils on one occasion?

Witness: Yes; the Italian workmen took one of the sight-holes out, and lowered the charge of coal out of the measure-box on to the charging stage. This allowed the coal to run down the combustion chamber into the nostrils, and bunged them up. So to clear them out I put a little powder in. The report was so slight that you could hardly hear it on the stage.

Fifth Day—Friday, April 14.

On the resumption of the case this morning,

Mr. *Leech* was recalled, and produced copies of plans which had been submitted by plaintiffs to Mr. Bourne, and approved and signed by him, on various dates between January and March, 1902.

In cross-examination by Mr. HAMILTON, witness said he took a book with him for the purpose of making notes of his conversations with Mr. Blow. When witness went to see the demolition of the furnaces in 1904, Professor Lewes went out to make a test of the producer gases; but Mr. Blow said it would take a week to prepare the furnaces, and Professor Lewes could not stay. The plans he produced were shown to Mr. Bourne and opened to him in witness's office. He knew the plans very well, as he was partly responsible for their preparation. He could not say that any of them were initialled by Mr. Bourne; but the whole of them were discussed between them.

Mr. HAMILTON: Can you put your finger on a single plan in that lot which shows the interior construction of the ovens?

Witness: No; but I have my original tracing of the brickwork furnaces which is not in this bundle.

Mr. *Tranfield* was recalled, and, in cross-examination by Mr. HAMILTON, said he was responsible for all the setting of the brickwork under Mr. Leech and Mr. Graham. They had small detail drawings as well as the large plan already produced. These were only pencil sketches of the size of the nostrils which led into the combustion chamber. They were destroyed; but he believed the tracings were in existence. Mr. Graham went through the matter with witness, and set out the shape of the nostrils in bricks, so that witness could follow

with the others. He did not actually set the nostrils himself, but he gave instructions to the men, and then he went over and inspected them, and saw that they had been properly done. Irregularities in the passages from the nostrils did not very much matter, providing there was sufficient room for the passage of air, and no liability to get choked. Of course, any irregularity in the brickwork would help dirt and dust to choke up the passage; but he did not see that there would be any difficulty in raking it out, as the flues were made so that they could be got at either from the combustion chamber or the underneath side of the gas arch. The combustion chamber was about 16 inches wide at the top, 12 inches at the bottom, and about 20 inches high. The gas arch was only about 12 inches in size; and a small boy could get in and clean out the nostril if there was anything in it. The nostril was about 2 ft. 6 in. long.

Mr. HAMILTON: My case is that the combustion chamber is not more than 12 inches wide. Do you really mean to say a man can go into it?

Witness: You need not go into it. You can clean it out with a rod from outside, and by bending the rod you can dislodge completely any material which gets there. If anyone went inside, the furnace would have to be allowed to cool down; but I could clean out the nostrils with a rod within half-an-hour of cooling the furnace.

In further cross-examination, witness said, of course, if a nostril had been left unperforated from the beginning, that would be bad work. In the pier walls the joints ought to be crossed, so as to bond the walls together; and it would be bad work if it was not bonded for a distance of 2 feet. If it was found that the pier walls had parted so that the fire passed from one chamber to another, it would be bad work also; but he could not say that this would leave traces on the walls. It was right that common red brick should be used for fillings; but this should be covered with a depth of refractory fire-brick. The fire-bricks in the gas-duct in the lower half of the setting ought to be 6 inches thick on the bottom, and 9 inches on the top; and this would be ample. If there was not sufficient thickness of fire-brick, the heat would get through and fuse the red bricks, and cause a collapse. He did not know what heat would be needed to do this; but it would have to be very great. He thought that, as long as he got a good lining of fire-brick, it did not matter what the filling was done with. Witness usually put the chippings of the fire-brick in the largest places which wanted filling; and these had been flushed with grout so as to make a solid mass. But this was never done where great weight rested on it. In most cases where it was done an arch was made on the top. In some cases the grout used was fire-clay; in others it was mortar grout. It was not wrong to use mortar grout.

Mr. HAMILTON: If walls were found without mortar throughout the brick, that would be bad work.

Witness: Yes.

If joints were found which gaped to the extent of a quarter or half an inch, that would be bad work, too?—It would be bad work if it was left like that from the first.

In the division walls which separate one combustion chamber from another, there are cases where the bricks are put on edge. Is that good work?—It is perfectly right, and makes no difference.

In some cases silica bricks had been used. Do they not expand with heat?—I do not know.

In some instances arch blocks have been used with the wide end at the bottom. Is that right?—Perfectly.

Does not it tend to make the bricks slip?—No. They were put in with Mr. Bourne's permission. That would be good work.

In reply to further questions, witness said he used his revolver to clear a nostril which had become choked with coal. Revolver cartridges were not used as a "rough-and-ready" way to clear out the nostrils from pieces of brick which choked them up during construction. He could not say that water was thrown on the hot coke so as to make an explosion which should have the effect of clearing out the nostrils. There was a question about using some different kinds of bricks when one sort ran out; but he believed this matter was arranged between Mr. Leech and Mr. Bourne. It was not true that the outer walls of one of the arches were not built true, and that they had to fill in with bricks or else leave a gap. If they got much heat in the setting, the natural tendency would be for the arch to sag a little. They could not put in work which would stand absolutely against the heats in a furnace of this kind.

Re-examined by Mr. SIMON: The method of clearing out the nostrils with a rod was quite the usual one, and was practical. He saw no difference of construction between the building at Edinburgh and that at Milan which could account for any difference of working. Witness did the brickwork of the buildings at Milan, at Edinburgh, and at Leeds; and, so far as he knew, they were all built alike. If two nostrils were found faulty at Milan, this was not bad work out of 1280. The crowns of arches in gas installations nearly always sagged, even when the installation was worked properly; and the sagging was not a sign of bad work. But where there was direct firing and the works were not used properly, this would increase the sagging. The only places where they used ordinary red brick was behind the fire-bricks in the proper and usual positions.

MR. HERRING GIVES EVIDENCE.

Mr. *W. R. Herring* said he had been interested for some years in the introduction into England of the inclined-retort system. Three years ago the Edinburgh installation was set up; and it was so satisfactory that a further installation was now being built. Witness was present at the interview with Mr. Green and Mr. Graham at Edinburgh, in January 1902, when the preliminary arrangements for the building of the Milan works were made. Witness saw a drawing produced by Mr. Graham and shown to Mr. Green. This was the same plan as that produced by Mr. Leech, and was what was known as a general working plan of a retort-setting. Mr. Green told witness that his Board (the defendants) were going to place an order with plaintiffs for inclined retorts; and the plan in question was then discussed. Witness remarked that for all practical purposes it was similar to the Edinburgh installation, except with regard to the generator. Mr. Graham said he had that working successfully at Leeds. He was also present in Milan when the regenerator walls were demolished. He examined the walls in eight settings, and found not the slightest indication of bye-passing. Witness was present at Milan in April, 1904. He saw the charges drawn; and the carbonization was carried out in a perfectly satisfactory manner—the heats, with one exception, being very good. The formation of the lump of carbon in Court was caused by wrong working, and had nothing to do with construction. The carbon was formed because the gas was not drawn away quickly enough. The producers in the Milan installation were ample in size. Witness was then examined as to the size of the producer at Milan, and as to its alleged difference from a published drawing of the plans of the Granton works which appeared in a recent issue of the "JOURNAL." He said that the depth of the coke curtain in the Milan works was 2 ft. 3 in.; that in the Granton works, 2 feet; and that in New Street, Edinburgh, works 1 ft. 6 in.. There was a mistake in the drawings by which the curtain was made 3 feet deep; and this, of course, was reproduced in the published drawing. When witness found this out, as it did not work well he immediately had it altered; but the drawing published contained the error. It did not make the smallest difference what shape the gas passages took, so long as there was space. He had gone through the whole of the particulars which were given by the defendants in pointing out alleged defects in the Milan setting; and there was absolutely no ground for them. The dimensions at Milan were quite sufficient to allow the clearing out of the nostrils. It was a great fault for the stokers to fail to put the torch to the retort-lids to prevent explosions; and in Edinburgh where a man failed to do this three times he was at once discharged. Witness saw the demolitions in Milan, and he said the works were generally very well built, and were in good condition except where there was local over-heating. It was quite a common thing in gas-works for cracks to occur from the heat; and these were put right when the works were overhauled. If this brickwork had not been constructed of the best material and workmanship, it would never have stood the improper working it had received. He did not think he had ever seen retort-setting work done so well as that at Milan, and standing so well after the treatment it had undergone during the period it had been at work. The signs of ill-treatment were evident in almost every wall that was exposed to his view.

Mr. SIMON: After your examination, did you find the works were faulty in construction and bad in design, so that there was a failure of the guarantee?

Witness: Absolutely no. All that was wanted was reasonable intelligence in using the plant.

In cross-examination by Mr. HAMILTON, witness said he had no doubt that the plans which were in witness's office at the time of the first interview with Mr. Green and Mr. Graham were seen and discussed between the three of them. It was not the cubical area of the producer which determined the amount of coal that could be carbonized, but the amount of the grate-bar area, and that was decided by the length and breadth of the grate. It was not so easy to stoke the grates as altered by Mr. Bourne as it was in the original shape.

Justice GRANTHAM asked if it was worth while to go into all these details.

Mr. HAMILTON said his case was that the defendants demonstrated by actual experiments that the alterations made by Mr. Bourne were improvements and not detriments to the furnace. Therefore, when it was said that the alterations destroyed the furnace, they had a right to show that the Graham furnaces did not do their work properly.

Sixth Day—Saturday, April 15.

On the hearing being resumed this morning.

Mr. *Herring* was further cross-examined by Mr. HAMILTON. He said in the plaintiffs' furnace the carbon monoxide passage should be constantly closed with the coke fuel. In working, the men in the service of the Company at Milan contiually let the fuel get below the aperture of the furnace. He saw this himself at the works.

THE JUDGE INTERPOSES.

Mr. HAMILTON was about to question the witness in detail as to the working of the fuel beds in the Graham furnace when

Justice GRANTHAM said: I do not want to stop proper cross-examination, Mr. Hamilton; but yours seems to me to justify what I said the other day. I do not blame you, but you are now endeavouring, by your cross-examination of this witness—a scientific gentleman brought here as an expert—to show that, in your opinion, and the opinion of those who are instructing you, the plaintiffs' system is not so good as some other system. I cannot see how this has anything to do with the case.

Mr. HAMILTON: I was not cross-examining, my Lord, to show that the plaintiffs' system is not so good as defendants', if by that you mean that Mr. Graham's furnace is not so good as Mr. Bourne's.

Justice GRANTHAM: What have we to do with the principle of the plaintiffs' furnaces?

Mr. HAMILTON: We suggest that they are inherently vicious and ill-constructed, because they were designed in a particular form.

Justice GRANTHAM: Assuming that is so, it is manifest that you knew it before, because you saw them at work; and I do not see how you can now describe a fault in it in principle as inherent vice, when the principle was plain all along. How can you say that can be called an inherent vice?

Mr. HAMILTON: When you say we knew what the furnaces were, that may refer to the drawings which plaintiffs say Mr. Green saw (and your Lordship has not yet heard Mr. Green), or it may refer to the construction which Mr. Bourne is said to have seen. We have an express guarantee in the contract that the whole thing is to be free from any inherent defect.

Justice GRANTHAM: How can you say it is an inherent defect because they did not do a certain thing in a certain way, and because your experts say that is the right way? I cannot see how it will be a defence to you to call witnesses to show that in their judgment the thing could be done better in another way.

Mr. HAMILTON: I am going to call evidence to show that, instead of certain things being good features, they are inherent defects.

Justice GRANTHAM: I should think it is almost impossible to see how you can be justified in saying that, after the furnaces have been erected on this principle, you are entitled to any number of thousands of pounds because, after all, you think some other principle would be better.

Mr. HAMILTON: The plaintiffs have contracted to erect an installation, and guaranteed it in a certain way. If it had certain inherent defects, the circumstance that we have worked it, and the circumstance that Mr. Bourne saw it being built, I shall submit on authority, do not in the least prove that we have no right now to rely on the breach of the guarantee.

Justice GRANTHAM: Does not this prove the correctness of my diagnosis of your case some days ago, when I said it was a fight between two systems—one French and the other English?

Mr. HAMILTON: No, my Lord; we are not in the least setting up another system against that of Graham and Morton. The inclined-retort system was the one we contracted for and wanted to get. Our criticisms are directed to the particular system, and to the designs by which Mr. Graham desires to carry out this system. However, I will take it as shortly as I can. The whole foundation of my case is the examination that has been made by highly experienced gentlemen of the system at Milan, and the advice they have given us on the matter. I do not want it to be said that anything these gentlemen might say took the other side by surprise because it was not put to their witnesses, and so that they can claim to have it excluded, or else recall the plaintiffs' witnesses.

MR. HERRING EXPLAINS THE CAUSE OF THE FAILURE.

In further cross-examination, witness said the signs of bad usage of the installation were principally the "fluxing" or bending of the bricks in the setting, under the high temperature which was allowed to prevail. The great point was that defendants' workmen had been treating the producers as if they were ordinary furnaces, and not as gas-producers at all. This was the source of the whole of the trouble. When he looked at the works in Milan, he saw at once what was the matter; in fact, when he saw the way in which the installation was treated he was astonished at the good results that were obtained. The principal points of failure were the irregular dealing with the air-slides, the direct firing, and the neglect to keep the producers filled with fuel. These failures always produced bad results; and if they had continued, the whole thing would have been melted. There were also the explosions which were allowed, and the shock of which would first be taken by the retort, and then be transmitted to the setting generally. There was a material amount of carbon encrusted in every one of the retorts opened in his presence. He never saw retorts anywhere in which there was so much carbon. Nevertheless the carbonization of the coal was going on fairly well; and this was what surprised him. His opinion was that about 2 feet of coke fuel was now sufficient. On Counsel referring to witness's book (where he stated that the amount needed was from 3 ft. 6 in. to 5 ft. 6 in.), Mr. Herring said the book was published in 1892, and it was now generally admitted that the smaller quantity was sufficient.

Mr. ISAACS said he had no questions to put to the witness.

PROFESSOR LEWES ON THE WORKING AT MILAN.

Professor *Vivian B. Lewes*, F.I.C., said he had had 30 years' experience in connection with the manufacture of gas; and in his opinion the plaintiffs' installation had no defects, and was an effective—he should say the most effective—application of the theory of inclined retorts. This system saved a good deal of labour and fuel, and the only drawback to it was that it required a little intelligence in working. When he was in Milan, it struck him that there was no management at all. He thought there was no competent direct supervision. The furnaces had not been worked properly, and their overheating had no doubt been caused by allowing the fuel to get too low in the producers. He entirely agreed with the evidence given by Mr. Herring. He saw the coal go into the retorts, and it was then dripping with water in a regular shower bath.

In cross-examination by Mr. HAMILTON, witness said he did not consider there were any signs of unequal heating in the retorts, but the signs of direct firing were in the flues leading to the combustion chamber. When the benches were being pulled down, there were clear signs in the combustion chamber that there had been undue heating, though the retorts were in excellent condition. In this system, good results depended on good proportioning in the installation; and bad proportioning would give them bad results. But they had always in their own hands, in an installation like this, the means of counteracting any slight deficiency in the construction. He had seen an ill-designed furnace worked so well, with high intelligence, that it did better work than a well-designed furnance badly worked. The coal used was very wet when put into the retorts, and it was quite possible that it might have suddenly reduced the temperature, and perhaps cracked them. But, as he said, the retorts were in good condition.

Re-examined by Mr. ISAACS: The effect of the use of wet coal on the carbonization would be great, as a large amount of heat which ought to have gone to the distillation of the coal would go to convert the water into steam, and this would mean the withdrawal of a great deal of heat which should go to the carbonization.

MR. CHARLES HUNT DESCRIBES WHAT HE SAW AT MILAN.

Mr. *Charles Hunt* said he was the first to introduce the system of inclined retorts at Birmingham. In May, 1904, he went, with Mr. Graham, Mr. Leech, Mr. Herring, and Mr. Shoubridge to Milan, to examine the installation there. The change made by Mr. Bourne in the furnaces in his opinion reduced the grate-bar area from about 15¾ square feet to about 9 square feet. The result was to reduce the openings through which the air would pass to the incandescent fuel; and he thought the object of the change was to lighten the labour of clinkering. They would therefore save labour by the change at the expense of the whole efficiency of the installation. He examined the producers as far as they were accessible; but some of them were filled with rubbish, and could not be got at. In one of these, the sides of the producer were burnt away, which clearly indicated direct firing. The gas outlet was also fluxed at the top end; and this would show that secondary combustion would be taking place at this point instead of upwards in the furnace. He found the same thing in one or two of the other producers. He saw one chamber which was accessible, and clinker had formed at the back, and partly in the gas outlet. The fact that it had risen as high as this showed that the fires had not been properly cleaned out, which would necessarily affect the efficiency of the producer. There was no difficulty in cleaning this if the right amount of labour was bestowed upon it, and the men worked properly. The clinkering in an ordinary producer should be done about every 24 to 48 hours; but a good deal depended upon the quality of the coal. If the coal was bad, clinkering must be done more frequently. He found the brickwork of the settings which were in course of demolition remarkably good. In one place it was out of alignment; but he put this down to the fact that it had been overheated. Generally speaking, the brickwork was perfect. There was indication of fluxing in the flues, which showed that excessive draughts had been used; and in one case the filling up in one setting was melted down, caused by direct firing. He saw deposits of carbon on several of the retorts; and he agreed with what had been stated in evidence as to the result on the working of the deposit of carbon. He had never before seen such large deposits of carbon as he saw at Milan. Asked how he accounted for these abnormal deposits of carbon, he replied that he thought the retorts must have been worked at a back-pressure, which would have nothing to do with the construction. As to the condition of the whole installation, except where the brickwork was fluxed, it was excellent. He could not see any reason for the setting being demolished. If it was because of the fluxing, this could have been prevented by working the beds at less pressure. He saw 13 or 14 retorts from the drawing stage, and watched the coke coming down. He judged that the charges of coal were fairly heavy, and they had been properly burnt off. He examined coke stacked in the yard, and found no traces of imperfect carbonization. He had visited the works built by plaintiffs at Leeds, and they were practically the same setting as those at Milan. They worked very well indeed.

Cross-examined by Mr. HAMILTON: He had not seen the Leeds works during their building, but he had examined the drawings and plans. He did not know from which part of the works at Milan the coke he saw came, but he did not think the Stettin benches were then working. The bench was being demolished when he was at Milan. He dissented altogether from the suggestion that the only difference between the grate-bar area of Mr. Bourne's and Mr. Graham's furnaces was about 46 inches in 1200 or 1300 inches. He thought the difference was at least 20 per cent. He thought Mr. Bourne's grate sacrificed a certain amount of efficiency. He found in one of the producers the sides were burned away at one point 6 inches into the material. It was usual to have it burned away about an inch; but he had never before seen so much as this burned. He thought the direct firing was caused by the carbonic acid, which ought to have gone up the flue, being prematurely ignited by air getting to it. He admitted that the higher up the carbon monoxide passage was, the less liability there was to clinker in it; but he did not think the liability to clinker in the Milan furnaces was because the passage for the carbon monoxide was so low down. It was because there was not sufficient clearing out of the clinker.

Seventh Day—Monday, April 17.

On the hearing being resumed this morning,

Justice GRANTHAM said: Now, Mr. Hamilton, you have very fully shown me by the cross-examination of witnesses what your points are. Having done that, it is of no use going over it all again. I should not exclude you proving your points by witnesses.

Mr. HAMILTON: No, my Lord. Now that you know my points, and the other side know what they have to meet, there will be no need to go into so much detail.

MR. HUNT GIVES FURTHER EVIDENCE.

Mr. *Hunt*, in further cross-examination by Mr. HAMILTON, said with regard to the brickwork there was no need for complete demolition. He admitted that there would be an appreciable amount of rebuilding necessary in the condition in which he saw the furnaces.

Mr. HAMILTON: That is to say, the brickwork, as you saw it, was in such a state that the benches could not have been made reasonably workable without a considerable amount of resetting and pulling down?

Witness: No; I do not go so far as that. In only one case was there a considerable amount of fusing of the filling. That, I think, would have to be removed and rebuilt; but in other cases it was more a matter of cleaning out than resetting. But the furnaces would not require extensive reconstruction, even if there were extensive bye-passing. A lining of fire-clay could be put in.

How could you get it in without rebuilding?—You could put in a flat paddle from each end. Of course, if the fault was due to bad construction, it would have to be rebuilt.

Cross-examination continued: He did not say that the back-pressure he spoke of, which caused the carbon deposits, would affect in any way the action of the producer or the circulation of the producer gas. It would be an indication of bad management, and would have an effect which would be shown in the financial results of the gas undertaking—that was to say, gas would be turned into carbon which ought to go into the gasholders for consumption. He had first to do with the inclined-retort system in 1891; and it had been in use before the erection of the Edinburgh plant in 1901.

Re-examined by Mr. ISAACS: The Brentford Gas Company adopted the inclined-retort system about ten years ago, Leeds about eight years, Birmingham about five or six years, and Manchester about seven years; while the Gaslight and Coke Company had had these retorts for a long time.

ADDITIONAL EVIDENCE AS TO THE WORK AT MILAN.

Mr. *J. S. Naylor*, who is now the Gas Engineer and Manager to the Rotherham Corporation, and was previously Manager of the Rochdale Road Gas-Works, Manchester, said he had had ten years' experience in regard to the brickwork of inclined-retort settings. In September

last, he was travelling in Italy on his holiday, and one day, when he was on the Cathedral tower, he saw the inclined retorts at San Celso. His curiosity was aroused, and he went to the works and was shown them. He examined the brickwork, and he must say it was splendid. He thought it was a great shame to demolish it. He inquired of the Engineer (Mr. Freyss) why this was being done; and he replied that it was because they could not get uniformity of heat, that there had been a fusion of bricks, and too much localization of heat. In his (witness's) opinion, this would be accounted for by improper working and the injudicious use of the dampers, which would produce direct firing. There was not the least difficulty in working the system properly, provided care was taken by those who operated the installation. So far as he could see, there was nothing in the brickwork, or the system, or the setting which could account for the fluxing. He had seen the Meadow Lane plant at Leeds, which was working well on the same principle as that at Milan. The heats were good and uniform, and the coke was well burned off.

Cross-examined by Mr. HAMILTON: It was about the 30th of September that he was at the Milan works, and he felt quite sure it was Mr. Freyss he saw. He was at the works about an hour or an hour and a half, and saw one of the benches being pulled down. He could not say if any of them were at work at the time, but he did not examine them all. He examined the brickwork closely, but saw no fluxing. He did not look into the furnaces, the gas-duct, or the regenerator, and all he saw of the retorts was the ends exposed by pulling down the front walls. He had seen Mr. Graham's work at other places, but was not very familiar with the system. If the dampers were wrongly adjusted for a day or two at a time, this would cause some fluxing; but to produce very much there must be almost continuous bad management. In a properly managed gas-works, they must get all the gas out of the coal when it was carbonized. He did not know there was litigation on the subject when he visited the works, and did not make any communication to plaintiffs as to what he had seen there till last November, when he met Mr. Graham in Manchester and told him.

Mr. *W. G. Waller*, a foreman retort-setter in the employ of the South Suburban Gas Company, said he visited the gas-works at Milan when a setting was being demolished. He found the brickwork splendid, and there was no indication of bye-passing. He looked for it, as it was something which was regularly looked for in these cases. He found the greatest amount of fluxing in the sixth wall; and the cause of it was local heating. There was no damper at all. The brickwork at that point was very much fused, which showed that the dampers were worked too wide open, and that the fuel was kept too low. The effect of this overheating upon the setting was that it had put it out of action; and it could not work. The damper passage was completely fused out. He did not see any cracks attributable to defective building. Witness was asked to tell his Lordship generally in what condition he thought the brickwork was, and he replied: "I think it was impossible to excel the quality or the workmanship of the settings."

Cross-examined by Mr. SPOKES: The fusing was at the lowest portion of the setting in each case; showing that there had been a greater draught there than at the upper half. He did not go into the question of the design of the carbon monoxide duct or the passages, as he assumed they were all right. He was not aware that the setting he saw was the one that defendants thought was the best, and which they had been trying to save. The whole of the dampers in the carbon monoxide duct were missing; but the work was then being demolished. However, the place where the damper should have been was so fused that the damper could not have been in position for months. The joints in the division wall were all perfectly bonded when he saw them. He saw the nostrils as the wall was demolished; and these and the air passages were perfectly clear. He looked at the regenerators in each bed, but did not see them working. He saw discoloration there, which would have shown bye-passing.

An Appeal for Relaxation.

Mr. SPOKES here made a personal appeal to his Lordship not to sit after Tuesday (to-day), as Counsel were all very much in need of their holidays.

Justice GRANTHAM agreed, but expressed regret, as he wanted, he said, to get on with the case.

More Evidence for the Plaintiffs.

Mr. *Henry Hulse*, the superintending carbonizing foreman at the Meadow Lane Gas-Works of the Leeds Corporation, said the works there were practically the same as those at Milan. He had been 19 years where he now was, and had had 34 years' practical experience in connection with gas making. He saw the benches at Milan, and thought they had not been properly worked. Asked if he had had any difficulty in working his Leeds installation, he said not the least. He attached much importance to the proper regulation of the slides and dampers. He always did this himself. It was necessary to keep the passages clear from clinker; otherwise they would not have any air getting through the passages. There was no difficulty whatever in clearing out the nostril holes. He saw the Milan furnaces in April, 1904, and the settings and brickwork were absolutely perfect. There was nothing in the principle, the setting, or the workmanship of the retorts which would account for the fluxing, if they had been properly treated. While at Milan, he noticed indications of back-pressure; they were not getting the gas pulled away. This was shown by the gas coming out; and the retort lids were blowing from the mouthpieces. He examined the retorts in one bed that was not working, and found them perfect. The condition of the producer he examined was very bad. He found clinkers 2 feet thick and 4 feet in length. This was decidedly too long; and he should not like to have them of this size in his furnace, as one could not work properly with them in. He found the main dampers very unevenly set, varying from 1 inch to 10 inches. This meant that it would not be possible to keep the heat in at all.

Cross-examined by Mr. SPOKES: He thought the day on which he saw the works was the 20th of April. He knew nothing of the plans; he only examined the working of the installation. There were only seven retorts at Leeds, so there was a much bigger collecting chamber for the carbon monoxide gas. It was equally easy to get from the exhaust chamber into the flues, both at Leeds and at Milan. He was not aware whether or not the joints were crossed. At Leeds they had a square hole near the nostrils, and had a bent iron to clear them out; but they did not often have to do this. The nostrils were built at an angle of 70 or 80 degrees.

Mr. ISAACS here said he had other witnesses, but would only call one more.

Mr. *S. Y. Shoubridge* said he had been concerned in the construction and management of gas undertakings for 30 years, and had great experience in inclined-retort settings. He was one of the first in this country to adopt them, and had designed them not only for this country but also for America and Japan. He went to Milan in May, 1904, to see a test of the Graham furnaces, and he agreed with the other witnesses that the fusing was caused by the fuel in the producers having been allowed to get too low, which caused extensive fusing. The building of the brickwork generally was excellent. He did not remember to have seen better brickwork anywhere. Asked as to his experience of the sagging of the arches, he said his opinion was that all arches would sag—it was quite inevitable, owing to the expansion which took place when the brickwork was heated. To guard against this, the beds were strongly tied in with steel rods and buckstays; but if these were tightened up, the rods would snap like carrots, so that a certain amount must be allowed for expansion. He saw proof in the producers that the fuel was kept too low, and he thought the change made by Mr. Bourne reduced by 20 per cent. the grate-bar area provided by Mr. Graham. The brickwork around the producer was actually burned away.

A brick which was partly melted was produced in Court, and Mr. SIMON said it had come from the actual producer in Milan.

In answer to further questions, witness said he visited Milan again for four days in January and February last. He carefully inspected the beds spoken to in evidence by the witness Waller. He saw no signs of improper sagging; and the brickwork, where it had not been improperly treated, was exceedingly good. In one place it was melted into a solid block, which would have been quite impossible if the works had been properly used. Some of it was silica brick, which would not fuse under 3000° Fahr. The heat there must have been intense. Two or three more samples of fused silica brick were here produced, and witness added that this brick was the most refractory material that could be employed. These samples proved a concentration of heat which would have been absolutely impossible under proper working. The heat should have been diffused and not so concentrated. It was evident from the appearance of the damper aperture that no damper could have been in position for some time. In his opinion, owing to the improper working, if the setting had not been very exceptionally well built the whole thing would have been run down long before. If properly worked, the heat where this fusing took place should have been a dull red, with which it was impossible to cause fusing. Mr. Marshall, one of the defendants' officers, admitted to witness that the walls were very well built. On the 31st of January he had a conversation with Mr. Marshall about a broken brick. He got a red brick which it was said had been used in the filling. He took it to Mr. Graham, who said it was a Morningside fire-brick which turned red with heat. It was afterwards tested. He examined the regenerator walls, and found that they were absolutely well built, and there was no sign of short-circuiting. He had never found difficulty in preventing this with ordinary brickwork without rebating, providing the work was well done. With regard to the nostrils, there was plenty of room for the passage of gas, even supposing there was some accumulation of dirt. There was no reason for the demolition. The defects could have been remedied at a cost of about £20 to £25 per bed. This amount would not run to much beyond the normal yearly repair of a gas bed. He could not see anything in the design which would prevent the installation working properly. It would produce 300 kilos. in a six-hour charge at 15 per cent. cost of fuel. As to the materials and the workmanship, they were of the best. On the assumption that the retorts were properly worked, he thought they would last 1000 days beyond the 600 days guaranteed. But in his opinion the installation was most improperly worked.

Cross-examined by Mr. HAMILTON: The red brick produced (a Morningside brick) came from the top of the carbon monoxide duct. He could not tell at what heat these bricks would fuse. He should think at about 2000° or 3000° Fahr. Where the silica brick was fused, the heat must have been between 3000° and 4000°. At Sydenham, the producers had the exits for the gas at the roof. The particular type of furnaces in question had not been worked in many places. From what he had seen of the working of plaintiffs' furnaces, he should be satisfied with a 2-feet fuel bed. The Stettiner Company, who were probably the largest gas installation builders on the Continent, were, he believed, now building 2-feet fuel-beds.

Mr. *Leech* was then recalled in order to identify certain specimens of bricks, &c., taken from various parts of the building.

Mr. HAMILTON asked that the plans of the Edinburgh settings might be produced, so that his experts might see them.

Justice GRANTHAM said it would be as well if the references to other works could be left out altogether.

This closed the plaintiffs' case.

The Case for the Defendants.

Mr. HAMILTON, in opening the case for the defendants, said that, grave as this matter was to Mr. Graham, it was no less so to the defendants, whose Board of Directors had been constrained, on the advice of a body of experts on whom they could rely, to take the great responsibility of demolishing, before their span of life was exhausted, four sets of benches which had cost some £70,000, and then found themselves compelled to abandon any attempt to make further use of the outlay. A number of experts had been called for the plaintiffs. For the defendants, there would be called a body of experts no less distinguished or experienced; and he hoped they would produce as much effect on his Lordship as the others. As to the counterclaim, the burden of proof was, no doubt, on the defendant; and it was probably worth the while of Mr. Graham to have £4000 retention-moneys held, so that when the action came on he might have both the first and the last word on the subject.

Justice GRANTHAM remarked that, to his mind, Counsel thought too much of having the last word. He should listen to the defendants' case as if he had not heard that of the plaintiffs.

Mr. HAMILTON said his case would be that bad design and bad workmanship might do all that the plaintiffs claimed was done by bad usage. But there was one thing bad handling could not do, and that was to put in bad bricks, and put them in upside down. If his Lordship believed the evidence the defendants could produce, taken over a much longer period than that of the plaintiffs, he would come to the conclusion that original bad construction was the only cause of the trouble. The defendants were entitled to submit that it was not enough for Mr. Graham to say: "This was my design, and that is what you bought." Defendants did not buy Mr. Graham's design. They did not buy a patent thing which they must be content with. They stipulated for a system of inclined retorts, operating under their method of construction, to be carried out, free from inherent vice in construction and design. The next important point was whether the defendants had said or done anything which precluded them from relying upon the terms of the contract almost in its entirety. It was said that Mr. Green saw the original designs, and that Mr. Bourne saw the work going on from day by day; and, in one way or another, this was suggested as some sort of answer to the defendants' counterclaim. He submitted that it could be nothing of the kind. His case with regard to the original plans was that Mr. Green went to Edinburgh before the contract was completed. He went to see the installation in full blast, and he made a report which did not mention any general arrangement of plan whatever. It might be that his Lordship would come to the conclusion that Mr. Green had forgotten that some kind of a general arrangement plan was before him; but this would not be approval of the design which would affect his employers, because there was no contract at the time. His friend Mr. Isaacs said the defendants took over the ovens, and therefore the only thing they could rely upon now was the guarantee for a period. He also said that since the defendants had altered the furnaces they ceased to be able to rely on the guarantees. The time guarantee was that the ovens would last for two years, fair wear and tear excepted. But well within the two years, and long before the end of 1904, it had become manifest that the benches, furnaces, and regenerators which had been originally deplorably put up, did not work properly; and if that was so, there was no answer to the breach of the guarantee. The cost of putting it right was recoverable. His case was that the bulk of the damage was inherent, and was not made worse by Mr. Bourne's alteration of the grates. The fact was that, so far as the grates were concerned, if there was any difference it was for the better, as the necessity for clinkering was less. This he could prove, because some of the furnaces were changed back again to the Graham system; and, though too late for plaintiffs' witnesses, evidence would be put before his Lordship which would show the superiority of the furnaces after Mr. Bourne had changed them. He submitted that the plaintiffs' guarantees had been broken; that the contract had never been fulfilled in its terms; that his friends could not recover their £4000; and that the defendants were entitled to substantial damages, not only on account of the broken guarantees, but also of the demolitions undertaken, without which a commercial company like the defendants could not have hoped to go on carrying on their business of supplying the city of Milan with gas.

EVIDENCE ON BEHALF OF THE DEFENDANTS.

M. *Jules Freyss*, a Technical Inspector in the service of the defendants, said he had been employed by them in various parts of the Continent. He went to Milan in 1904, and on examining the furnaces there found the heat very unevenly distributed. The bottom was white hot, while up at the top it was nearly black, with no heat at all. He found the gas-producer too small, and the carbon monoxide duct too restricted in section. Some of the dampers were very difficult to move; and he thought the angle at which the nostrils were built encouraged the formation of ash and carbon. Witness produced a number of photographs and drawings of the various parts of the installations made under his personal supervision.

The further hearing was adjourned till to-day (Tuesday).

Claim for a Radiator.

At the Clerkenwell County Court, last Wednesday, before his Honour Judge Edge, the Tubular Bath Boiler Company, Limited, of Gray's Inn Road, sued the Corporation of Coventry for £6, less 10 per cent. discount, in respect of a radiator supplied to them. Mr. Davis appeared for the plaintiffs; Mr. Nielson represented the defendants. Mr. W. H. Bushell, the Managing-Director of the Company, said they received a written order from Mr. F. W. Stevenson, the Engineer and Manager of the Coventry Corporation Gas Department, for one of their eight-section "Hermetica" steam-radiators; and it was forwarded on the terms of 10 per cent. discount for cash. The amount was not paid, and in the subsequent correspondence Mr. Stevenson said that, on making a test, he found the radiator did not bear out the statement of the plaintiffs, that the gas consumption would be only 1½ cubic feet per hour. In answer to Mr. Nielson, witness said he tested the radiator in his office before it was sent out, and found it satisfactory. Counsel proceeded to read from a circular issued by plaintiffs, in which they stated that the burner, being made in proportion to the size of each radiator, it could not raise the steam pressure to more than 5 lbs., which caused the radiators to produce a temperature of 228° Fahr., or nearly 100° more than an ordinary radiator charged with hot water would give. They further stated: "Gas consumption only 1½ feet per hour for an eight-section radiator. Gas at 2s. 11d. per 1000 cubic feet will supply these radiators for warming an office for a nine-hour working day, for one-halfpenny." Mr. Stevenson, Counsel continued, on the 20th of February made a test of the radiator from eight o'clock in the evening until nine o'clock the following morning. All the doors and windows of the office were shut; but after this 13 hours' test the temperature of the place was found to be only 53° Fahr., the outside temperature being 38°. A second test was made the next day, commencing at nine o'clock in the evening and lasting until nine o'clock the following morning. When it commenced the temperature of the office was 51° Fahr., and at the end of the twelve hours it was the same. Mr. Stevenson then wrote to the plaintiffs that he was returning the radiator, as it would be ridiculous for the Corporation to attempt to sell an appliance under a statement which was not correct. Professor Lewes had thoroughly tested the radiator, and had found precisely the same result as Mr. Stevenson. His Honour remarked that he had a very poor opinion of expert evidence generally; and therefore he thought a test ought to be made when the plaintiffs' representatives were present. They should have every opportunity of showing that the radiator could do what was claimed for it. He could not see that there was any defence to the claim. The contract was one under which the goods passed on delivery; and any complaint about the representations made, or any claim for damages, should form the subject of a cross-action. Mr. Neilson submitted that it was a case of sale by description, and that the property did not pass until it was accepted by defendants as being satisfactory and according to representation. His Honour said he could not accept this view; and he found for plaintiffs for the amount claimed, with costs. Defendants would, he said, be given every facility for bringing a cross-action. Mr. Nielson said it was their intention to do this. As he had in Court several witnesses from Coventry, and also Professor Lewes, he asked if his Honour would take their evidence, to save their attendance again. His Honour replied that, when the case came on, he would hear them.

The Bankruptcy of Mr. Ellis Lever.

At the Bangor Bankruptcy Court, last Thursday, before Mr. Registrar Glynne Jones, Mr. Llewellyn Hugh-Jones, the Official Receiver, made an application in the matter of the bankruptcy of Mr. Ellis Lever, now residing in Colwyn Bay, whose examination had on several previous occasions been adjourned owing to the unsatisfactory character of the debtor's statements. On the debtor taking his seat at the table, the Official Receiver said this was a case in which, after the first hearing, the bankrupt had been ordered to prepare a cash account covering a period of ten years. This was not satisfactorily complied with, and at a subsequent hearing, on the representations of the debtor's Solicitor, the order was amended to the production of a cash account covering a period of five years, and now this was found to be quite unsatisfactory. He was bankrupt for £4000 or £5000, and could not show how the money had gone. There were outside creditors to the amount of £900; and the fact that the bankrupt had no explanation to offer in respect of the moneys received, he submitted, justified him in saying that this was a bankruptcy not properly explained, and he therefore asked for an adjournment *sine die*. Mr. Lever remarked that he could only say that as soon as he was in a position to pay his creditors he would do so. Mr. J. W. Barton, who appeared for Mr. Lever, submitted that his client had done all he could, and that therefore the examination ought to be closed. The Registrar said that, as the debtor had failed to comply with the order, he must adjourn the examination *sine die*.

Stealing the Commercial Company's Gas.

At the Thames Police Court, on Monday, the 3rd inst., a middle-aged man, named Edward Humphreys, in business as a mat maker, at 289, High Street, Poplar, was charged before Mr. Mead with stealing a quantity of gas, valued at 19s. 4d., the property of the Commercial Gas Company. Mr. G. H. Young, who prosecuted, said that although the prisoner was charged with stealing gas worth 19s. 4d., there was no doubt he had been taking it for many years, both at 39, Robin Hood Lane, and at his present place of business. Humphreys had become so emboldened by success that no gas at all passed through the meter. Suspicions at length being aroused, Samuel Whitbread, a fitter, went on the 22nd ult. to the prisoner's shop, and took the index of the meter. It registered 16,100 cubic feet. Whitbread had previously taken the index for the Christmas quarter, when it registered the same quantity. Inquiries were then made, and on the 30th ult. Whitbread, in company with Mr. Brown, the District Engineer, went to the house. They saw gas burning in the shop parlour; and on looking at the main tap found it had been turned off, so that no gas could pass into the meter. On going into the cellar, they found a compo. pipe hanging from the ceiling with a rubber pipe attached to one end, and the other end connected with the service-pipe. There was also a tap, which was open at the time. The prisoner was the first to get into the cellar, and he caught hold of the tube and pulled it off, with the result that the gas escaped. Had not Whitbread promptly turned off the tap, a serious explosion might have occurred. The prisoner afterwards put the tubing into his pocket. The burner in the bed-room had a supply-pipe connected with it, so that it could be served from the same illicit pipe. When Detective-Inspector Nicholls took the prisoner into custody, he said, "Can't I go to the Company's office to settle this?" In a drawer the inspector found a piece of tubing which was strongly impregnated with gas. Mr. Mead said the offence was a very bad and mean one; and he sentenced the prisoner to three months' hard labour.

At the same Court, before Mr. Dickinson, the following Thursday, two youths named Thomas Oatman and Thomas Heuer, were charged with breaking into No. 77, Bromley Street, Stepney, an unoccupied house, and stealing 9d., belonging to the Commercial Gas Company. Detective Pye noticed prisoners loitering about Bromley Street. They went to the house in question, the door of which they forced with their backs, and entered it, closing the door behind them. The officer, on going to the door, heard them tampering with the gas-meter. He forced the door and saw the accused standing under the meter, which was fixed in the passage. They were secured by the detective. Oatman had the cash-box of the meter in one hand and 9d. in the other, while Heuer was holding a piece of iron and the padlock of the meter. His Worship remanded prisoners prior to sending them to a reformatory.

MISCELLANEOUS NEWS.

DEVONPORT GAS MANAGEMENT.

Allegations against the Engineer—Demand for Investigation.

The affairs of the Devonport Corporation Gas Department occupied a large amount of attention in the borough last week. They were discussed at a town's meeting in a noisy and excited manner, and afterwards at two meetings of the Town Council, as well as in numerous letters in the local papers. The public meeting was held on Tuesday evening. It was presided over by the Mayor (Mr. E. Blackall), and was called to consider the condition of the undertaking.

Mr. S. D. Brooming, who said he was present because of the "deadset" made against the Gas Engineer, moved—"That having regard to the differences which admittedly prevail between the Council's experts and the Gas Committee, this meeting of ratepayers requests the Corporation to appoint a thoroughly independent Committee to report upon the present and future prospects of the undertaking." The question of the rival systems of water-gas manufacture was, he said, a matter for experts to settle; but they were all interested in the straight conduct of the public men of the town. They should know, or the Council should know, what charges the Gas Committee had to make against the Engineer. Mr. A. Stroud, as a member of the Gas Committee, seconded the motion. Mr. P. C. Goodman, who is also a member of the Gas Committee, supported it. The meeting, he said, was called to strengthen the hands of those members of the Council who were in favour of an investigation into the working of the Gas Committee. Whenever the Committee had gone wrong, it was because they had not acted upon the advice of those who knew. The Gas Engineer had resigned under pressure. Why did they want to get him out of the way? Let the Chairman of the Committee say where he obtained his information in support of the carburetted water-gas system. He did not have it from the Engineers. Did it come from interested men? No harm could be done by inquiry; and if the Council appointed a Committee who could make a searching investigation, they would arrive at the truth.

Alderman W. Hornbrook, the Chairman of the Gas Committee, who rose in response to the calls of the meeting, gave an emphatic denial to certain charges against himself hinted at by previous speakers; and referring to the water-gas question, he said that nearly every engineer told them not to have anything to do with "blue" water gas. It had been said in the Council that the time had come when either the Chairman or else the Engineer must go. Well, he was not going. He was Chairman of the Gas Committee; and as long as he occupied this position, he was not going to allow four or five members of the Council to sit in judgment on him and his Committee. Alderman W. Littleton contended that in so important a matter as the extension of the gas-works they ought to be guided by expert advice. The Gas Engineer had been forced to resign; and the whole circumstances ought to form the subject of an inquiry. Mr. H. Jarvis said he was in favour of the Engineer's resignation, because the Council had decided to adopt carburetted water gas, and he did not consider it right that a person who was opposed to this system should control the works.

The resolution was eventually carried by an overwhelming majority.

Discussion in the Council.

A Meeting of the Town Council was held on Thursday. On the presentation of the minutes of the Gas Committee, Mr. R. H. Rendle asked what amount of capital expenditure would be required to complete the gas-works, assuming that the plans of the Consulting Engineers were carried out. Alderman Hornbrook said so many things were suggested that one could scarcely tell where it was going to end. What was immediately before them was the question of a water-gas plant. In his opinion, if they had an installation of water gas they could apply themselves to the repairing of the retorts and retort-house, and there would for years be no necessity to spend the rest of the money.

Proceeding to move the confirmation of the minutes of the meeting of the Gas Committee held on the 8th inst. (at which Mr. Sidney E. Stevenson tendered the resignation of his appointment as Gas Engineer, which the Committee resolved to accept), Alderman Hornbrook said that what had happened during the last few days had made it not only possible, but a matter of public duty, that he should say what he could not say before. A letter had also appeared in that day's paper signed by the Gas Engineer, demanding that he should now say what he had to say. Mr. Stevenson was asked this question in Committee: "Will you prefer that I, as Chairman, should make any statement, and you now reply to it, or do you wish to tender your resignation, or what course do you wish to adopt?" Mr. Stevenson asked them for time to consider the position; but the Committee thought there had already been time enough to think it over, and Mr. Stevenson thereupon offered to resign. Then came the public meeting, at which certain charges were made against him (the speaker). He did not know whether this was the particular time to both answer these charges and to make his full statement with regard to the differences between Mr. Stevenson and himself. [The Mayor: By all means say what you have got to say, and let us settle this question.] When he entered upon the duties of Chairman of the Gas Committee, he had the very highest opinion of Mr. Stevenson; but his experience had caused him to have opinions which were very adverse to him. Soon after he became a member of the Committee, tenders for coal had to be considered, and the names of all the contractors were placed before them by the Manager. The names were read out one by one, and the members of the Committee wrote them down. There was one name—he would call it Pit A—which offered coal at 12s. per ton. The Engineer said that this was no good, and would not suit them at all. Near the bottom of the list there was another tender from Pit A at 12s. 3d.; and they were recommended to accept this. When the Engineer's attention was called to the fact that he had previously condemned the very same coal when offered at a lower price, his answer was that he did not think he had said that. This left a very bad impression on their minds. Then there came up the matter of contracts. The Engineer recommended that they should not have a contract for meters, and said that there was one for cartage which they could not break. It ultimately turned out that there was no contract for cartage; and they made one which resulted in a saving of between £40 and £50 a year. As to meters, they had samples from three firms. The Engineer said it was no good having one of a certain make, and that he had tried it before. They took advice, and were told that the meters were made of tin of excellent quality; and when they were weighed, these meters were found to be 1¼ lbs. heavier than the others. Then the Engineer said that the firm would not send them meters equal to the sample, to which he (Alderman Hornbrook) replied that it would be time enough to deal with that when they found the goods were inferior. Mr. Stevenson also said: "If you go on like this, these people will get all the contracts, because they are not in fair competition with other people; they do not belong to the 'ring.'" The Committee replied that they had nothing to do with the "ring"—"No 'ring' for us." Well, their expenditure on meters for the year was £1205 12s. 1d.; and there was not only this difference of 1¼ lbs. in the weight, but a saving of 5 per cent. in the price, or over £60 on the contract. They did not think any the better of the Engineer for that. Then there was the supply of main-cocks. Two tenders were received. One morning while he was at breakfast, a young man came to him and told him he had seen at the gas-works one of the sample cocks put in a vice and practically spoiled. He (the speaker) went to the gas-works. The Engineer showed him a perfect cock, and one that had been tampered with. He worked it in his hands; and it was so loose that he could see daylight through the joints. He (the speaker) said: "That is a nice thing for the contractor to send; the Committee will condemn it in a moment, you had better send and get another." Another was sent for, and it was marked by four people before it was delivered. Going to the works half-an-hour before the time for the Committee meeting, he saw the Engineer with this sample in his hands working it about in the same way. When it came before the meeting, he (Alderman Hornbrook) called attention to it. The main cock was to all intents and purposes spoiled. This statement was either true or false. He would stand in any Court of Law with reference it, and take his chance; and if he had to pay for it he would do so, because it was in the interest of Devonport. He spoke to Mr. Stevenson privately about the matter; and he denied it. But when asked if it was possible for someone else to have got it done (because they knew for a certainty it had been done), he said: "Well, I may as well tell you I did it. I sent it down to Callaghan." Callaghan afterwards told him he had altered one of the main cocks by the Manager's orders. The Manager asked him not to say anything about it; and he promised that, for his wife and family's sake, he would not. He would not have said a word about it if other things had not transpired. [A Member: Why is the Engineer not here? The Mayor: The Engineer knew the meeting was to be held, and he has been accustomed to attend the meetings; but he is not here now.] Alderman Hornbrook went on to refer to the issue of tenders for the new holder. In the advertisements it was stated, by order of the Committee, that the tenders were to be forwarded to the Town Clerk. When the plans and specifications were sent out, the line was added: "This contract must be filled up and sent to Sidney E. Stevenson, Engineer, Devonport Gas-Works." He (Alderman Hornbrook) had intimation that, under the altered circumstances, two of the contractors refused to tender. When the Committee heard of it, they were astonished, and ordered that the tenders were to be sent to the Town Clerk as directed. By and by there were other tenders; and he was present at a sub-committee meeting when they were produced. Each of the envelopes was sealed as perfectly as when sent out; but the bottoms of nearly the whole of them had the appearance of having been opened. This was noticed by another member of the Committee, as well as himself. They did not know who had opened them; but he told the Town Clerk that in future no one was to touch the tenders until they were opened in Committee by either the Town Clerk or his deputy. He had been accused of having gone himself to the Town Clerk's office and asked to see certain tenders and open them; and that on being refused this, he took the envelopes and held them up to the light. There was no truth in the allegation; and the Deputy Town Clerk (who was given as the authority for the statement) denied it, and said that the purpose for which he went to the Town Clerk's office was to see that his orders with regard to the custody of the tenders were carried out. [The Town Clerk, interposing, explained that formerly tenders were sent sometimes to him and sometimes to the Gas Engineer; but that if they came to him they were sent to the Engineer so that they could be opened at the sub-committee meeting and collated.] Alderman Hornbrook said that he was personally accused of two offences, either of which if true ought to send him to Dartmoor Prison for the remainder of his life. If they were true, let some independent Committee of the Council find it out. This was what he advocated; but he did not agree that a Committee should be appointed by the Council to go into the policy and working of the Gas Committee. He had referred to one of the accusations against himself. The second had reference to some bank notes. Just before a meeting of the Gas Committee, he had drawn a number of notes from the bank, and these he placed in a pocket in which he had a newspaper cutting. At the close of the business, he took out this newspaper cutting to show it to some of the members; and the notes fell out of his pocket. Mr. Jarvis said, in a joking way: "Governor, give us one of those. I dare say it was a present to the Chairman." This was all that took place. Yet the Engineer, who was present, went to the Town Clerk and told him that he had seen the envelope in which the notes came, and had it in his possession; and that they were taken by him (Alderman Hornbrook) out of the envelope. Another little incident arose out of complaints of nuisance caused, as was alleged, by leakage of gas. The Engineer told the Committee that it had nothing to do with the gas; but on further complaints being made, the Borough Surveyor and the Gas Engineer were asked to investigate the matter. The Engineer then admitted that it was the gas, and said he could soon put it right. On being reminded of what he had previously said, he

replied: "I knew it all the time; but do you think I was going to acknowledge that?" This was one of numerous incidents in the last two years, until the time had come that he had not the slightest faith in the Engineer. He was sorry to have to say it, and did not want to say it. He did not wish to injure the Engineer or his family; and if he had erred at all, it was in not bringing these things up before. What he had stated he was prepared to substantiate in any Court of Law in the land; and if he had made any misstatement, he was willing to pay for his mistake.

The motion was seconded by Mr. H. Banbury, who quoted from the monthly returns of the gas-works alleged discrepancies in the figures. In the comparative statement, the figures given as the amount paid in wages for the corresponding weeks of the previous year did not agree with the figures which he said actually appeared in the returns for the corresponding weeks. He must leave the Council to judge why the figures were cooked and manipulated. The Gas Committee were determined to operate the gas-works, not for the benefit of three men, but for that of Devonport. They ought to get another Engineer, and let him report upon the extensions which were necessary. If he said water-gas plant was unnecessary, then let them drop it.

Mr. R. Stephenson moved as an amendment that the matter be referred back to the Gas Committee. He explained that he was not related to the Engineer; and that he had voted at a previous meeting in favour of the adoption of carburetted water gas. He knew that the Engineer was prepared to faithfully carry out the wishes of the Committee in the matter; but to the surprise of the whole population of Devonport, a resolution was passed on Saturday removing him from his position. They had heard that morning a lot of charges against the Engineer to substantiate the action of the Committee; but some referred to what took place months, and even years, ago. Why, if these things were true, had they not heard of them before? Why was nothing said about his removal until after the resolution on the 4th inst. about the adoption of carburetted water gas? They ought to give him an opportunity of replying to the accusations, and not adopt the unfair and un-English course of condemning him unheard.

Mr. J. C. Tozer seconded the amendment. He said that at a previous meeting he had upheld the Engineer, because he knew no reason why he should not. To-day he had to say that, if the statements of the Chairman of the Committee were true, he should support the Chairman. The accusations were serious if true, and more serious if not true. It would be only fair that the Engineer should be asked to give his explanation.

Considerable discussion followed as to the course of procedure; and Alderman Hornbrook had risen to reply when the Mayor interposed and moved the adjournment of the meeting until the following day, and that the Engineer be then asked to attend. This was unanimously agreed to.

The Manager's Action.—Legal Proceedings Threatened.

When the Council again met on Friday morning, Mr. S. E. Stevenson was present, accompanied by Mr. P. T. Pearce, his Solicitor. Letters addressed to Alderman Hornbrook and Mr. Banbury were handed to them by Mr. Pearce as they entered the Council Chamber.

The Town Clerk read a letter which he had sent to Mr. Stevenson on the previous evening informing him that certain charges having been made against him by the Chairman of the Gas Committee (Alderman Hornbrook), the Council desired to hear what he had to say in reference thereto. He also read a letter from Messrs. Bond and Pearce, Solicitors, in which they intimated that Mr. Stevenson would withdraw his resignation for the following among other reasons: "(1) That the causes inducing, and the circumstances surrounding, such resignation, especially the promise of three months' salary in lieu of notice, do not appear to have been officially reported to the Council, and certainly are not recorded in the minute in question; and (2) some members of the Council appear to have stated that Mr. Stevenson would not have resigned had he wished an inquiry, thus impliedly suggesting his anxiety to burke one, which was contrary to the fact, as he courts and intends, as far as he is able, to have a thoroughly searching and most rigid investigation." They added that, in view of the litigation which, in the absence of withdrawals and apologies, must follow, Mr. Stevenson would not make any statement at this stage of the proceedings with regard to the scandalous and false accusations which had been made concerning him.

Alderman Hornbrook said he wished to correct a statement he had made on the previous day as to the number of meters which were ordered. He could not trace any entry of the matter in the books, and instead of the specific statement—900 was to the best of his belief the number—he would prefer that it should read to the extent of several hundreds. In further justification of the Committee's report, he wanted to refer to the contract for pipes in Ford Valley. When the tenders came in, the Engineer objected to one because it did not comply with the specification, which said that the pipes must come from the manufacturer only and not from an agency, and that it did not tell the name of the manufacturer. He (Mr. Hornbrook) pointed out that the tender in question was certainly the lowest by £147, and the Sub-Committee decided to accept it. When the name of the manufacturer was written for, it turned out to be a firm who had tendered at a much higher sum. He put that together with the cartage and the meters and the main cocks—in regard to which the difference in price represented a saving of from £200 to £300—and in all these things he was opposed by the Engineer, though supported by a majority of the Committee. He asked the Council to confirm the minute accepting the resignation of the Engineer.

Mr. G. H. Smith asked whether it was true that Mr. Stevenson had £100 sent him by cheque from a certain firm and refused to accept it. If that was the case, it should be known to the Council. Alderman Hornbrook said he heard something about it, and brought the two men face to face in the Committee. The Engineer then denied that he had ever said anything of the kind.

The amendment that the minute be referred back to the Committee was then rejected by 32 votes to 18, two members being neutral; and the resolution confirming the acceptance of Mr. Stevenson's resignation was carried by a large majority.

Alderman Littleton had given notice to move that the resolution accepting the tender of Messrs. Cutler and Sons for carburetted water-gas plant be rescinded; but he said that under the circumstances he did not propose to move it. He left it to the discretion of the Gas Committee to do what they thought best.

The Consulting Engineers and the Extension of the Works.

A letter appeared in the local papers on Saturday from Messrs. Stevenson and Burstal, the Consulting Engineers to the Corporation, replying to the allegation made by Mr. F. Paul, a member of the Gas Committee, that the Engineers were responsible for the delay in proceeding with the erection of the retort-house. Mr. Paul said at the public meeting of ratepayers that if a retort-house had been asked for it would have been built, and that every step in the improvement of the works had been taken in hand when they were advised it was necessary. Messrs. Stevenson and Burstal quote passages from their reports to show that as early as July, 1902, they strongly urged the construction of the whole works at as early a date as possible, and that by the construction of a new retort-house a very considerable improvement would be effected. Early in 1903, they advised that the work ought to be ready if possible by the winter of 1904, but certainly for the winter of 1905. After this they were instructed to prepare drawings and specifications for contracts for the purifiers and condenser, and for the new holder and tank and the connecting pipes. They were also instructed to report upon the cost of installing the water-gas plant in a temporary position; and they took this opportunity of again strongly urging the Committee to proceed with the erection of the retort-house—pointing out that until then no material improvement in the cost of manufacture could be made. After referring to their report in corroboration of this, Messrs. Stevenson and Burstal say: "We have been constantly expecting to receive instructions to proceed with the drawings and specifications for the whole of the work; but whatever the cause may be, the question of constructing the new retort-house appears to be dropped out of consideration altogether."

THE GAS SUPPLY OF EDINBURGH.

Smells at the Granton Works—Educating the Consumers—Price of Gas for Public Lighting.

A Meeting of the Edinburgh and Leith Gas Commissioners was held on Monday, the 10th inst.—BAILIE BRYSON, of Leith, presiding.

The CHAIRMAN moved, in terms of a recommendation by the Works Committee, that gas be supplied to the Corporation of Edinburgh for the year from the 15th of May, for public lighting, at the price of 2s. 5d. per 1000 cubic feet for flat-flame burners, and 2s. for incandescent lighting.

The motion was carried by nine votes to four.

Bailie M'KELVIE asked Mr. W. R. Herring, the Gas Engineer, if, in view of the agitation with reference to the smells from the Granton works, he could inform the Commissioners what steps he had taken to remove or mitigate the nuisance complained of, and the result of his experiments in this direction.

Mr. HERRING said that under the Gas-Works Clauses Acts the Commissioners were compelled to purify the gas. To do this, the best type of plant had been put down at Granton; and he could assure them that it was being worked in the best known manner. Some time ago they authorized him to put down some appliances in order to partially or wholly do away with the changing of the material in the purifying-boxes. So far, this had reduced the number of changes by about 10 per cent. They were, however, continuing to experiment with a view to still further increase the efficiency of this practice. Still more recently they had authorized him to abandon the use of lime for the purification of the sulphur compounds. This had very considerably reduced the odours emanating from the purifiers while being charged; and it had also prevented the nuisance arising from the transport of the spent gas lime through the town. A Bill had passed through Parliament this session authorizing the London Gas Companies to abandon the use of lime, and adopt the same method of purification as was in vogue in the Granton Gas-Works. He was of opinion that the complaints were very much exaggerated, and that there were other sources from which smells might come. In the locality, there was a chemical works; and they were not odourless.

Bailie M'KELVIE said he was quite satisfied with the explanation. He had come to the conclusion that the agitators were making a mountain out a molehill.

The CHAIRMAN, in supplement to what Mr. Herring had said about revivifying *in situ*, said they were also duplicating the purifiers at Granton; and he believed that by next winter they would not require to open them so often as they had had to. This would be another means of reducing the smells.

The Works Committee reported that they had had before them the remit as to the advisability of adding to the efficiency of the general lighting by incandescent or other approved means, and that they had continued the remit. In connection with this subject, a memorandum by Mr. Herring has been issued to the Commissioners. In this document, Mr. Herring, after referring to the work that has been done in the matter of reorganizing the staff since the complaints of "bad gas" were made some five years since, goes on to point out the benefits to be derived by consumers by the employment of incandescent mantles instead of flat-flame burners. With the object of educating the consumers in the proper use of the gas they burn, it was deemed expedient to open up some additional show-rooms, situated in the main public thoroughfares, where a large number of the general public would be sure to see the wares put on exhibition, and the samples of domestic and shop lighting there exhibited. These

epôts were also of very considerable utility as district offices in connection with the Gas Commissioners' business; and, in Mr. Herring's opinion, they were necessary, even although no cash sales take place. The following up of inquiries made at the respective depôts was now being more vigorously prosecuted by the chief inspector of this department. Parties making inquiry at the show-rooms for any type of appliances have their names and addresses recorded, and the inspector's duty is to wait upon them thereafter and advise them what is best to be done to accomplish the object they have in view. In some places gas suppliers undertake, for a small charge per quarter, to maintain incandescent burners in a thoroughly efficient state, supplying any number of renewal mantles that may be required. He was not, however, at the moment prepared to advise the adoption of such a practice in their own district of supply. Mr. Herring then goes on to say:

It appears to me that our present practice of selling the goods and appliances at the lowest possible cost, and placing our inspectors' knowledge and experience at the service of the public, and, in the case of large installations, a regular and periodical supervision of the lighting, is as far as we need go until the need of our services is better appreciated by the public than it appears to be at the present time. The public will, undoubtedly, soon learn to appreciate the fact that the incandescent system of lighting is not only the best, but the most economical; and as we are prepared to demonstrate its adaptability to every possible circumstance, it seems to me that this can only be done by the addition of district depôts in populous centres, where demonstrations can be made, and where the residents in the locality can obtain the best advice and the best articles for giving them the light they require. The depôts are used primarily as district offices for the transaction of the Commissioners' business, such as orders for gas supply, cookers and appliances, coke fuel, and intimations of gas escapes, deficient supplies, &c., &c., in addition to which they are sale rooms for gas appliances. . . . There is a clear profit of £34 1s. 9d. in connection with the show-rooms as a depôt for the sale only of goods, or 10·3 per cent. on the business done. There is, however, a much more important aspect of this question than has yet been dealt with. During the period that the shops have been opened, we have taken orders for the hire of 389 cookers, the purchase price of which amounts to £1231 16s. 8d. The yearly rental of these stoves amounts to £166 18s. 11d., or 13·5 per cent. on the purchase price. The profit on the additional gas sold by the introduction of these cookers, without adding anything to the cost of service-pipe or meter, or to the establishment charges and other items concerned with the running of the concern, amounts to £304 11s. 1d. per annum.

In dealing with the question of the price of gas for public lighting, the Commissioners had the benefit of a letter which had been sent to each of them by Mr. Herring, in which he stated that as he was aware that the current year's financial results would be rather more favourable than the last published accounts, he was of opinion that the Commissioners would be safe in fixing the price for ordinary public lighting at 2s. 5d. per 1000 cubic feet, as at present. As to their continuing to supply gas at 2s. per 1000 cubic feet for incandescent street-lamps, Mr. Herring wrote:

It is for the Commissioners to determine whether it is worth their while continuing to supply gas for this purpose at so low a rate. It practically represents the bare cost of material and labour in the manufacture of the gas, and does not make the public lighting so supplied bear any part in paying the interest on the money employed in the undertaking. Personally, I am of opinion that the satisfactory lighting of the public streets is undoubtedly of advantage to the gas undertaking by satisfying the public, and proving to them the efficiency and economy of gas lighting. The better lighting of the streets will undoubtedly cause the public to be dissatisfied with the present methods of interior lighting. They will thus, by means of the incandescent burner, improve their lighting; and, seeing that every incandescent burner yields 90 candles of illumination for the same 3 feet of gas which yields only 12 or 13 candles when burned in a flat-flame burner, economy must result in the gas consumed.

Discussion in the Town Council.

At a Meeting of the Edinburgh Town Council last Wednesday (presided over by Lord Provost Sir ROBERT CRANSTON), when the report as to the illuminating power of the gas was submitted,

Mr. W. W. MACFARLANE said that the Lord Provost was aware that he had addressed a letter to him as Chairman of the Gas Commission, He was sorry the Lord Provost was not present at the Commission when the letter was considered, as otherwise he might have had more courtesy shown him. He had received an answer from the Clerk to the Gas Commission, which he would read, and leave the members to judge of the contents. In it the Clerk stated that he had been instructed to reply that Mr Herring had reported what he had done in connection with Mr. Macfarlane's house, and that if Mr. Macfarlane wished Mr. Herring to do anything further he would be glad to have a letter on the subject. Mr. Macfarlane, proceeding, said he was not an expert, and could not tell any official what would be necessary to give a better installation. He would like to have better gas; but it was not within his province to tell Mr. Herring how it was to be done.

Treasurer BROWN said that some time ago a remit was made to the Town Clerk, Bailie Mallinson, and himself to get further independent tests regarding the gas, and that the Cleaning and Lighting Committee were unanimous in asking that the remit be extended to include the taking in of the highest expert opinion that could be got—probably that of the adviser to the London County Council. He was of opinion that the time had come when the ratepayers should be satisfied as to the quality of the gas.

The LORD PROVOST said he was in a most awkward position, being Chairman of the Gas Commission and also Lord Provost. He thought it was his duty to take the citizens' interest before that of the Gas Commissioners. He had raised the question whether the candle power should be 20 at the place where it was consumed; and he had been informed in the Commission that the gas had to be 20-candle power at Granton. He held that this was a wrong reading of the Act. He asked the Council to leave the question with him in the meantime; adding that the Commission were anxious to give the best light. The Commission had nothing to do with considering incandescent burners; and he thought the citizens were entitled to get 20-candle power gas at their houses.

The subject then dropped.

At a later stage in the proceedings, a discussion arose upon the proposal of the Cleaning and Lighting Committee to the effect that 1950 of the present gas-lamps be converted into incandescent lamps at an initial cost of £4022, and a permanent annual cost of £788.

Bailie MALLINSON, who moved the recommendation, said the Committee thought the extension of the incandescent lighting must be done gradually, from the financial point of view, and because they did not know what developments there might be in public lighting. If the proposal was agreed to, it would still leave 5650 of the old flat-flame lamps. He then went into a comparison of efficiency of incandescent

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 154.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Apl. 13	10½	Alliance & Dublin 10 p.c.	21—22*	..	4 15 5
160,000	10	,,	7½	Do. 7 p.c.	14—15*	..	5 0 0
200,000	5	Nov. 11	6½	Bombay, Ltd.. . . .	6¾—7¼	..	4 9 8
140,000	5	,,	6½	Do. New, £4 paid	5—5½	..	4 14 6
50,000	10	Mch. 15	14	Bourne-) 10 p.c. . .	29½—30½	..	4 11 10
251,810	10	,,	7	mouth Gas) B 7 p.c. .	16½—17½	..	4 0 0
53,200	10	,,	6	and Water) Pref. 6 p.c.	15½—16½	..	3 12 9
380,000	Stk.	Feb. 24	12	Brentford Consolidated	247-252	..	4 15 3
300,000	,,	,,	9	Do. New . . .	18.—190	..	4 14 9
50,000	,,	,,	5	Do. 5 p.c. Pref. .	127—132	..	3 15 9
206,250	,,	Dec. 15	4	Do. 4 p.c. Deb. .	105—108	..	3 14 1
220,000	Stk.	Mch. 15	11	Brighton & Hove Orig.	223—228	..	4 16 6
246,320	,,	,,	8	Do. A. Ord. Stk. .	165—170	..	4 14 2
460,000	20	Mch. 30	10	British	40½—41½	..	4 16 5
100,000	Stk.	Feb. 24	6	Bromley, Ord. 5 p.c. .	118—123	..	4 17 7
165,700	,,	,,	4½	Do. do. 3½ p.c. .	90—94	..	4 15 9
500,000	10	Oct. 13	7	Buenos Ayres (New) Ltd.	12½—13	..	5 7 8
250,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb. .	96—98	..	4 1 8
150,000	20	Mch. 15	8¼	Cagliari, Ltd.	25—27	..	6 2 3
100,000	10	Sept. 29	10	Cape Town & Dis., Ltd.	17½—18	+¼	5 11 1
100,000	10	Oct. 27	4½	Do. 4½ p c Pref.. .	9¾—10¼	..	4 7 10
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	52—54	..	5 11 1
50,000	Stk.	Dec. 30	4½	Do. 4½ p.c. Deb. Stk.	100—102	..	4 8 3
1,400,000	Stk.	Feb. 24	5⅛	Commercial 4 p c Stk. .	115—118	—1	4 8 1
560,000	,,	,,	5	Do. 3½ p.c. do. .	111—114	—1	4 7 9
450,000	,,	Dec. 15	3	Do. 3 p.c. Deb. Stk.	86—88	..	3 8 2
800,000	Stk.	,,	6½	Continental Union, Ltd.	110—113	—1	5 15 1
200,000	,,	,,	7	Do. 7 p c Pref.	140—145	..	4 16 7
424,070	Stk.	Feb. 18	5¼	Derby Con. Stk. . . .	123—125	..	—
55,000	,,	Jan. 3	4	Do. Deb. Stk. . . .	108—110	..	3 12 9
486,090	10	Jan. 27	11	European, Ltd. . . .	22—23	..	4 15 8
354,060	10	,,	11	Do. £7 10s. paid	15—16	..	5 3 2
15,243,200	Stk.	Feb. 10	4⅛	Gas-) 4 p.c. Ord. . .	97½—98½	..	4 9 4
2,600,000	,,	,,	3½	light) 3½ p.c. max. .	92—94	..	3 14 6
3,799,735	,,	,,	4	and) 4 p.c. Con. Pref.	110—112	—2	3 11 5
4,193 975	,,	Dec. 15	3	Coke) 3 p.c. Con. Deb.	90—92	..	3 5 3
258,740	Stk.	Mch. 15	5	Hastings & St. L. 3½ p.c.	100—103	..	4 17 1
70,000	10	Sept. 29	11	Hongkong & China, Ltd.	16¾—17¼	..	6 5 9
3,800,000	Stk,	Nov. 11	10	Imperial Continental .	218—221	..	4 10 6
473,600	Stk.	Feb. 10	3½	Do. 3½ p.c. Deb. Red.	96—98	..	3 11 5
175,242	Stk.	Mch. 15	6	Lea Bridge Ord. 5 p.c. .	120—125	+2	4 16 0
561,000	Stk.	Feb. 24	10	Liverpool United A . .	221—223	..	4 9 8
718,100	,,	,,	7	Do. do. B . .	162½—164½	..	4 5 1
306,083	Stk.	Dec. 30	4	L'rpool Unit'd Deb. Stk.	111—113	..	3 10 10
75,000	5	Dec. 15	5	Malta & Medn., Ltd. .	4—4½	..	5 11 1
560,000	100	Apl. 1	5	Met. of) 5 p.c. Deb..	101—103	..	4 17 1
250,000	100	,,	4½	Melbourne) 4½ p.c. Deb.	101—103	..	4 17 1
541,920	20	Nov. 11	3½	Monte Video, Ltd. . .	11½—12½	..	5 12 0
1,565,892	Stk.	Feb. 24	4½	Newc'tle & G'tesh'd Con.	109—111	+2½	4 3 4
406,025	Stk.	Dec. 30	3½	Do. 3½ p.c. Deb.	92—93	..	3 15 3
15,000	10	Feb. 24	10	North Middlesex 10 p.c.	19—20	..	5 0 0
52,940	1	,,	7	Do. 7 p.c.	13—14	..	5 0 0
300,000	Stk.	Nov. 30	8	Oriental, Ltd. . . .	148—151	..	5 6 0
600,000	5	Mch. 30	7	Ottoman, Ltd. . .	6—6½	..	5 12 0
235,005	Stk.	—	6½	Plym'th & St'house 5 p.c.	—	..	—
398,490	5	Apl. 28	6†	Primitiva Ord. . . .	6—6½	..	4 12 4
796,980	5	Jan. 27	5	Do. 5 p.c. Pref. .	5—5¼	+⅛	4 15 3
488,900	100	Dec. 1	4	Do. 4 p.c. Deb. .	96—98	+1	4 1 8
851,070	10	Oct. 13	7	River Plate Ord. . . .	13½—13¾	..	5 3 8
300,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb. .	97—99	..	4 0 10
250,000	10	Apl. 13	7	San Paulo, Ltd. . . .	12½—13*	..	5 7 8
70,000	50	Jan. 3	5	Do. 5 p.c. Deb. .	52—54	..	4 12 7
135,000	Stk.	Mar. 15	10	Sheffield A	234—236	..	4 4 9
209,984	,,	,,	10	Do. B	234—236	..	4 4 9
523,498	,,	,,	10	Do. C	233—235	..	4 5 1
123,998	Stk.	Mch. 30	5	Shrewsbury Ord. 5 p.c.	102—105	..	4 15 3
70,000	10	,,	11	South African	16—17	..	6 9 5
6,250,000	Stk.	Feb. 10	5⅛	South Met., 4 p.c. Ord.	127—129	—1	4 5 3
1,832,700	,,	Jan. 13	3	Do. 3 p.c. Deb.	89—91	..	3 5 11
575,000	Stk.	Feb. 24	5⅛	S'th Suburb'n Ord. 5 p.c.	120—123	..	4 9 5
60,000	,,	,,	5	Do. 5 p.c. Pref. .	122— 27	..	3 18 9
112,533	,,	Jan. 13	5	Do. 5 p.c. Deb. Stk.	130—135	..	3 14 1
502,310	Stk.	Nov. 11	5	Southampton Ord. . .	107—110	..	4 13 11
87,950	,,	—	4	Do. 4 p.c. Deb.	—	..	—
120,000	Stk.	Feb. 24	6½	Tottenham) A 5 p.c. .	125—128	..	4 17 8
338,720	,,	,,	4½	and) B 3½ p.c. .	93—101	+1	4 14 1
125,000	,,	Dec. 15	4	Edmonton) 4 p.c. Deb.	107—110	..	3 12 9
182,380	10	,,	8	Tuscan, Ltd.	9⅜—10½	..	7 16 1
149,900	10	Jan. 3	5	Do. 5 p.c. Deb. Red.	100—102	..	4 18 0
30,000	Stk.	Feb. 24	7½	Wands-) A 5 p.c. . .	163—168	..	4 12 3
255,636	,,	,,	6½	worth) B 3½ p.c. . .	135—140	..	4 9 3
60,000	,,	,,	5½	and) C 3½ p.c. . .	111—113	..	4 16 0
57,564	,,	Dec. 30	3	Putney) 3 p.c. Deb. Stk.	82—87	..	3 9 0
745,872	,,	Mch. 15	5	West Ham 5 p.c. Ord. .	102—104	..	4 16 2
185,000	,,	,,	5	Do. 5 p.c. Pref. . .	123—126	..	3 19 4
193,300	,,	Dec. 30	4	Do. 4 p.c. Deb. Stk.	105—110	..	3 12 9

Prices marked * are Ex div. † Next dividend will be at this rate.

and arc lighting; incandescent gas was much the better of the two. They had decided, in the interests of the ratepayers, to ask an independent expert to make tests both of the electricity and the gas. Of course, it must be understood that, while the tests to be made would be thoroughly independent, they would have to consult with their Gas Engineer.

Further consideration of the subject was adjourned till next meeting.

CHEAPER GAS FOR MOTIVE POWER AT LONGTON.

The Longton Town Council, at their monthly meeting, had before them a recommendation of the Gas and Electricity Committee that for the coming year a sum of £2500 be handed over to the borough fund; that an amount of £500 be carried to reserve fund each year; and that from Sept. 30 next the price of gas to ordinary consumers and for street lighting be reduced 2d. per 1000 cubic feet, and to users for motive power purposes 3d. per 1000 cubic feet. A Sub-Committee appointed to go into the question of the cost of public lighting, reported that they had exhaustively considered the advisability of lighting all the public lamps free of charge, and were of opinion that at the present time it was not desirable to make any change.

When the Committee's minutes came up for confirmation, Mr. French moved that the recommendation to reduce the price of gas should be omitted. Knowing, as a member of the Finance Committee, that the Council might have one of the Committees with a large deficiency, he wished to ask which they considered advisable—to lower the price of gas by 2d. per 1000 cubic feet (meaning reducing the income of the works by £1200); or to maintain the price of gas as at present, and give the money to the relief of the rates, out of which the deficiency to which he referred would have to be met. Mr. Tams objected to the gas consumers having to pay the deficiency of the Education Committee; and Mr. Shelley thought that they should not hand over any money to the rates until the loans on capital account were reduced. He said the gas-works had been bled far too much in the past; and in these days of scientific discovery some new process of gas manufacture might be found which would revolutionize the existing system, and necessitate a large capital outlay, if they were not to fine the gas consumers by continuing with obsolete plant. He thought the Committee made a mistake in not having a stronger reserve fund. He was sorry it was proposed to hand £2500 over to the rates; the Council should be content with £2000. He recognized that the price of gas was high; it ought to be 2s. 3d. per 1000 cubic feet. But it was the bad management and bad financial arrangements of the past which crippled the works. The borough was having to pay 10½d. per 1000 cubic feet of gas made as interest on capital. The works were well managed; but it was not known how soon a capital outlay might be necessary.

Only four voted for Mr. French's amendment; and the minutes were adopted.

SALES OF STOCKS AND SHARES.

At the Mart, Tokenhouse Yard, E.C., last Tuesday, there was a crowd of investors eager to secure portions of the stocks and shares which Mr. Alfred Richards had notified in our columns his intention of offering for sale by order of directors and others. The principal gas feature of the sale was an issue of £10,000 of ordinary "C" stock and £5000 of 4 per cent. perpetual debenture stock of the Ilford Gas Company. The former ranks for a standard dividend at the rate of 5 per cent. per annum, subject to the sliding-scale; the dividends on the Company's ordinary "C" stock having been paid at the rate of 6 per cent. per annum since the first issue five years ago. The new issue was placed at prices ranging from £120 to £120 10s. per £100 of stock; and the total produced was £12,003; the debenture stock selling at £101 5s. to £101 10s. per £100. Another new issue was £15,000 of 5 per cent. preference stock of the South Essex Water-Works Company; and it was sold at from £125 10s. to £126 5s. per £100, *cum div.* as from the 1st prox. A small parcel of 300 ordinary shares of £10 each in the Great Yarmouth Water-Works Company fetched £10 2s. 6d. to £10 7s. 6d. each; and £2000 of 4 per cent. perpetual debenture stock was sold at from £105 to £106 per £100. Some fully-paid new ordinary £10 shares in the Southend Water Company, ranking for a maximum dividend of 5 per cent. per annum (the last dividend having been at this rate), fetched from £10 12s. 6d. to £10 15s. per share; and 25 fully-paid additional ordinary shares, of the same nominal value, ranking for a maximum dividend of 7 per cent. per annum, but carrying 5 per cent., were sold at £12 5s. each. Under instructions from executors, some "A" stock of the Horley District Gas Company (last dividend 8 per cent.) was offered for sale, and was purchased at £154 and £155 per £100. Some 5 per cent. preference stock of the Company was sold at par; and two 4 per cent. debenture bonds of £50 each were sold for £103 10s.

Water Supply to Tenement Houses.—Inquiry was made of the Metropolitan Water Board by the London County Council whether, in the event of owners of tenement houses being required to supply fittings to provide for a supply of water being given to each tenement floor, the Board would be prepared to afford the supply, and to what extent. In reply, the Board have stated that, without prejudice to their statutory rights, they will be glad to co-operate as far as possible in the direction desired by the Council, and will be prepared to accept in tenement houses similar arrangements to those adopted in the case of blocks of houses constructed by the Council. "It is, of course, understood," the Board observe, "that proper arrangements would be made to prevent the lower floors taking away the pressure from the higher ones during the busy times of the day, and, further, that the Board would not contribute in any way towards the cost of providing the necessary pipes and fittings in the houses. It is desirable that the Chief Engineer of the Board should be communicated with in each case before arrangements for an improved supply are commenced."

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The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily.
BLACKBURN	1,250,000	ST. CATHERINES (Remodelled)	250,000	TONBRIDGE	300,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	KINGSTON, PA.	125,000	STRETFORD	500,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	PETERBOROUGH, ONT.	250,000	OLDBURY	300,000
COLCHESTER	300,000	WILKESBARRE, PA.	750,000	TODMORDEN	500,000
BIRKENHEAD	2,250,000	ST. CATHERINES (2nd Cont.)	250,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
SWINDON (New Swindon Gas Co.)	120,000	BUFFALO, N.Y.	2,000,000	YORK (Second Contract)	750,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	WINNIPEG, MAN.	500,000	ROCHESTER (Second Contract)	500,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000	COLCHESTER (Second Contract)	300,000	NEWPORT (MON.)	250,000
HALIFAX	1,000,000	YORK	750,000	TOKIO, JAPAN	1,000,000
TORONTO	250,000	ROCHESTER	500,000	PERNAMBUCO (Brazil)	125,000
OTTAWA	250,000	KINGSTON, ONT.	300,000	MALTON	150,000
LINDSAY (Remodelled)	125,000	CRYSTAL PALACE DISTRICT	2,000,000	DULUTH, MINN. (2nd Cont.)	300,000
MONTREAL	500,000	DULUTH, MINN.	300,000	BROCKVILLE (ONT.)	250,000
TORONTO (Second Contract Remodelled)	2,000,000	CATERHAM	150,000	SMETHWICK	500,000
BELLEVILLE	250,000	LEICESTER	2,000,000	GRAVESEND	300,000
OTTAWA (Second Contract)	250,000	ENSCHEDE (HOLLAND)	150,000	NEWPORT MON. (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000	BUENOS AYRES (RIVER PLATE CO.)	700,000	TORONTO (Third Contract)	750,000
		BURNLEY	1,500,000	TORONTO (Fourth Contract)	1,000,000
		KINGSTON-ON-THAMES	1,750,000	MONTREAL, ONT. (2nd Cont.)	1,800,000
		ACCRINGTON	500,000	HAMILTON, ONT.	400,000

LEEDS, 1,800,000 C. Ft. LEICESTER (2nd Cont.), 1,000,000 C. Ft. NEWCASTLE-ON-TYNE, 1,800,000 C. Ft.

AND IN ADDITION, 7,500,000 CUBIC FEET DAILY; also Coal-Gas Plants at NELSON, B.C., CHATHAM, BERLIN, NAPANEE, OWEN SOUND, CALGARY, and WINNIPEG.

METROPOLITAN WATER BOARD.

Staines Reservoirs Scheme to be Completed.

At the Fortnightly Meeting of the Board last Friday—Sir R. M. BEACHCROFT presiding—the Works and Stores Committee reported on the proposed completion of the Staines reservoirs communication works (New River district), and stated that, so far as the works of the New River Company were concerned, the scheme was nearly finished in the first section, but that the whole of the expenditure incurred up to the present, amounting to nearly £1,030,000, was rendered useless until the connecting link was provided. The works now suggested to complete the connection were estimated to cost £152,400. The Committee, therefore, recommended that this estimate should be approved, and that they should be authorized to invite tenders for the work. The Finance Committee reported that they had considered the estimate of £152,400. They gave particulars of the scheme, the total estimated cost of which was £1,141,311, which, after deducting £749,755, the amount expended by the New River Company up to the appointed day, and £32,256 in cash handed over by the Company, left a sum of £359,300. They submitted the estimate of £152,400 in respect of the additional works proposed to be undertaken as chargeable to capital account, and recommended that application should be made to the Local Government Board for their consent to the borrowing of the sum of £359,300. The Board adopted the recommendations of the Committee.

THE CHARGES OF THE BURY WATER BOARD.

Following on the appeal of Mr. T. Wilkinson, of Radcliffe, against the charges made by the Bury Joint Water Board, reported in the "JOURNAL" last week (p. 114), Mr. C. H. Pickstone a few days ago made an application to the Radcliffe Magistrates to assess the appellant in respect of his three cottages upon the net sums received by him, in accordance with the order of the Court. Mr. Pickstone said the present assessment was on the wrong basis, and it was only the Magistrates who had power to change it, and make it on the sum received by the landlord after the local rates had been deducted. They granted the application, and allowed Mr. Pickstone £5 5s. costs. Mr. J. Haslam, the Clerk to the Joint Board, said they had decided, subject to confirmation that afternoon, to issue with the demand notes, which were made out on the old basis, an intimation that the Court had decided that certain persons were entitled to some deductions. These could hardly be made on the notes for the present quarter, but they would be allowed. The Board estimate a deficit of £4200 as the result of the decision. To meet this, the Finance Committee have recommended a discontinuance of discount on houses of £30 rent and upwards, and a reduction of discounts on water sold from 10 to 2½ per cent. But this scheme will only yield £2200.

THE RIVINGTON ARBITRATION AWARD.

Question of an Appeal from Mr. Justice Warrington's Decision.

At the Meeting of the Liverpool Corporation Water Committee last Tuesday, the Chairman (Alderman Burgess), at the close of the ordinary business, made a long statement respecting the recent litigation in regard to the award in the Rivington arbitration. In the course of it, he explained that when the Corporation valuers first valued the property, they discarded from consideration any value it might have as a water-bearing area, and the figures furnished by them—viz., £40,000—did not include any water value. In the case of Mr. Lever, a specific claim was set up to water rights; and during the arbitration a plan was put in showing how it was proposed to use them. In respect of these rights, Mr. Lever claimed £50,000. The Corporation contended that he was not entitled to compensation in respect of these rights, as no scheme could be devised which would be commercially practicable for intercepting the water on the area in question which would not interfere with the natural defined watercourses on which the Corporation and other owners had riparian rights. Accordingly, in regard to this item of Mr. Lever's claim, the Corporation contended that a question of title arose which the Umpire had no power to adjudicate upon, and that it was his duty to award a separate figure in respect of it. By including it in the total award, he rendered the award liable to be set aside, unless it could be shown that Mr. Lever was entitled to the water rights claimed. At the trial, this point was argued out; and the Umpire having admitted that he entertained the claim for water rights and adjudicated upon it, evidence was tendered on behalf of the Corporation to show that the plaintiff had no title to divert the waters which would be intercepted by the proposed catchwater. Mr. Justice Warrington decided, however, that all matters dealt with by the Umpire were within his jurisdiction, and upheld the award. With regard to the point raised respecting the Umpire's health, this was a matter which was introduced by the City Council upon the report of Dr. Glynn. But, in view of the evidence given by him at the trial, it would appear as if the effect of the report had been misunderstood; and accordingly, at the instance of the Judge, the Counsel for the Corporation withdrew the plea. Freed from this outside consideration, the matter resolved itself into the simple question of law whether or not the Umpire, in entertaining the water claim, which involved questions of title, had taken a course which vitiated the award. This was the ground upon which the Committee in the first instance decided to contest the award, and it would now be their duty to take into consideration the Judge's decision on the point.

Mr. C. H. Rutherford remarked that they had lost before Mr. Justice Warrington, but they had succeeded in obtaining an admission from the Umpire that he adjudicated upon Mr. Lever's claim in respect of water rights. This they were advised he had no jurisdiction to do, and that he ought, at the utmost, while adjudicating upon the question of fact—how much money he thought should be awarded in respect of

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such rights—to have stated a case for the Court to decide on the point of law whether Mr. Lever had any such rights as were claimed on his behalf. He (Mr. Rutherford) would like to see the Committee advised now by leading Counsel as to whether they ought not to succeed in the Court of Appeal in upsetting the judgment of Mr. Justice Warrington, and in holding that the award was bad.

The Chairman remarked that the point mentioned would be considered very carefully by the Committee; but perhaps it could be more freely discussed in private. At the same time, he thought that Mr. Rutherford had taken the proper course in alluding to it. Whether the award was to be upheld or not, they were bound to regard it as a most exorbitant sum, and very considerably in excess of anything that would have been paid by any man for the property.

The Committee then proceeded to deliberate upon the subject in private. After discussing various points for about an hour, it was decided to defer further consideration of the matter until the meeting of the Committee to-day.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Of the meeting of the Waverley Association of Gas Managers at North Berwick last Thursday there is little to be said, because the proceedings were short. It looked a little curious, at first, that of all who took part in the discussion there was not one who belonged to the Waverley district, although two of the gentlemen formerly did. This circumstance was not due to the absence of representatives of the district; but it may probably be accounted for by the fact that few of them have to compete with electricity, and therefore had nothing to say upon the subject under discussion. It was a pleasure to see Mr. J. M'Gilchrist, of Dumbarton, again in his place. Another great pleasure—which was doubtless the reason why there was so large an attendance, and probably explained why more was not said at the meeting—was the visit to the new gas-works of the Corporation.

The municipal management of the gas undertaking in Edinburgh and Leith is almost monopolizing attention at present. This week we have had a meeting of the Gas Commissioners, at which some important business was transacted, as will be seen from a report upon another page. This was followed by the publication in the newspapers of Mr. Herring's letter of advice to the Commissioners; and then, on Wednesday, the Town Council of Edinburgh had an innings upon the subject. In addition, there has been the annual dinner of the Gas Commissioners, and some further newspaper correspondence dealing with the illuminating power of the gas.

At the Commissioners' meeting, ground was first broken over the proposal of the Works Committee to supply gas to the Corporation of Edinburgh for public lighting at the price of 2s. 5d. per 1000 cubic feet for consumption in flat-flame burners, and at 2s. per 1000 cubic feet for consumption in incandescent burners. Four out of the thirteen members of the Commission who were present objected to the supplying of gas for incandescent lighting at less than it costs to produce it; but the other nine carried the recommendation of the Committee.

The Town Council had the same subject of street lighting before them on Wednesday, but did not get it much advanced when an adjournment was made. Prior to this discussion on public lighting, the Council had before them the question of the illuminating power of the gas. It was introduced by Mr. W. W. Macfarlane, who had a letter of complaint to the Gas Commissioners two days previously. The position is this: Mr. Macfarlane says that the gas is bad, and that if it is not improved a sweep of the Gas Commissioners will be made at the next municipal election. But Mr. Macfarlane's position is easy of acceptance compared with that of Lord Provost Sir Robert Cranston. Mr. Macfarlane is not a member of the Gas Commission; but the Lord Provost is Chairman of that body. He confesses that he finds himself in an awkward position in holding both offices. Why? Because he considers it his duty to protect the interests of the citizens before those of the Gas Commissioners. He informed the Council that he held it to be a wrong reading of the duties of the Commissioners that they were to supply gas of a certain illuminating power at the gas-works only. If an agitation against the illuminating power of the gas is to be indulged in, it is scarcely the duty of the Chairman of the Gas Commission to be one of those at the head of it, unless he be able to put forward the most convincing of reasons—which, in this case, we have not yet got.

Returning to the meeting of the Gas Commission, we find that they devoted part of their time to a consideration of the subject of the alleged smells from the Granton Gas-Works. Mr. Herring's reply to Bailie M'Kelvie disclosed the interesting facts that the use of lime for purification has been abandoned at Granton, and that they are experimenting with the revivification of oxide of iron *in situ*. What is being done by the Commissioners will be watched with interest, because, if they succeed in mollifying this community—which is perhaps the most finical in the world—other bodies supplying gas need have little to fear in the matter of trouble on account of smells.

A meeting on the same subject, presided over by Sir John Murray, K.C.B., was held in Edinburgh on Thursday evening. The extent of the discontent may be measured by the fact that, although it was mentioned that the Provisional Committee had received as many as 450 letters and documents of complaint, only about eighty persons attended the meeting; and it was reported that £178 had been subscribed to the funds of the Provisional Committee. A Committee of twenty were appointed, which presumably exhausts the full effective strength of the movement. The Gas Commissioners could, indeed, afford to despise the movement, were it not for the two reasons that there are several eminent men on the newly appointed Committee, and that the proposal is not to proceed in the private capacity of the discontented, but through the Local Authorities. They have received advice to this effect from

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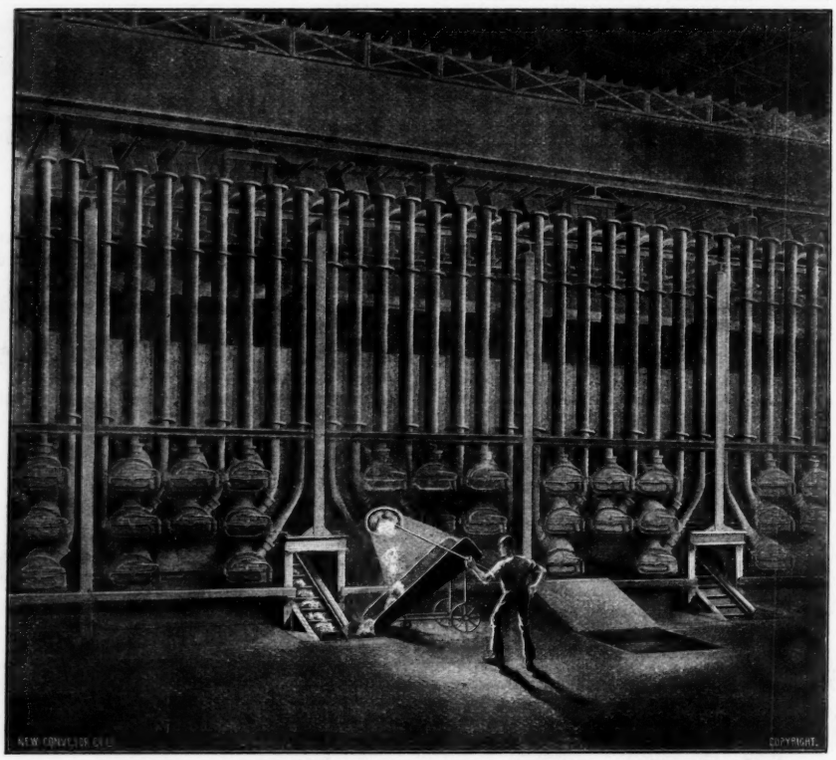

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the Secretary for Scotland; and they mean to act upon it. There is danger in this proposal, because, if a prosecution be instituted, it will be both promoted and defended upon the funds of public bodies—and we know how eagerly professional gentlemen catch at such litigations, and how costly they are. It is only considerations such as these which make the matter important, and which should lead the Commissioners to consider carefully what they do, because of the risks of litigation.

Assuredly the Gas Commissioners of Edinburgh and Leith are, at the present moment, not reclining upon a bed of roses. They are called in question in the matter of the illuminating power of the gas, and in this connection are practically summoned to submit their product to the scrutiny of a neutral party; they have litigation threatened over these alleged smells; and they are already in Court over the alleged pollution of a brewery well, which may also prove a very costly affair.

The Edinburgh and Leith Gas Commissioners held their annual dinner in the Balmoral Hotel, Edinburgh, on the evening of Thursday last. The chair was occupied by Bailie Bryson, of Leith. In acknowledging the toast of "The Gas Commission," the Chairman remarked that, notwithstanding the competition of the electric light, and their gas being reputed to be of bad quality—which they said was not the case—the consumption of gas was going up by leaps and bounds. Last year their output was 1943 million cubic feet—an increase since the Corporation took over the gas, 16 years ago, of 670 millions, equal to 52 per cent. At the transfer they had 61,920 consumers on the books; to-day they had 86,089, which included about 6000 penny-in-the-slot meter consumers. In 1894, the number of public lamps amounted to 10,919; last year they were supplying 11,574. The price charged for gas had varied from as high as 4s. 6d. in 1892, to 2s. 9d., their present price; so that the gas industry was fairly holding its own. After mentioning the agitation with regard to the smells from the gas-works, he went on to refer to the extensions at Granton. At the end of the last financial year, the capital expenditure on the works amounted to £500,000. Since then contracts had been let and wages paid to the extent of £92,147; and they fairly expected, when the present extensions were finished, to have the most up-to-date and the best-equipped gas-works in the country. The toast of "The Gas Commissioners' Officials," proposed by Judge Grieve, was responded to by Mr. Gibb.

The Perth Town Council on Monday discussed the proposal to reduce the illuminating power of the gas to the statutory standard of 20 candles. Mr. Cuthbert, the Convener of the Gas Committee, in moving adoption of the proposal, said it was not intended to reduce the candle power to 20 at once, but that, in the first instance, they might reduce it to 23 candles. The previous question was moved and supported, on the grounds that incandescent gas lighting could only be successful if it was used with suitable fittings. Mr. W. B. M'Lusky, the Engineer and Manager, pointed out that the special gas-fittings required cost 4½d. each. The motion to reduce the candle power was agreed to by 18 votes to 4. The Council accepted tenders for coal which, under the new order of things, represent a saving of £1750.

CURRENT SALES OF GAS PRODUCTS.

Week ending April 15.

London makers remain firm in pitch; and their attitude is justified by a recent sale of a good quantity at 33s. net at maker's works. Business has been done in 90 per cent. benzol at 8¾d. net, and 9d. is now asked; the demand being large. For 60's crude carbolic, 1s. 9¼d. net is obtainable.

The tone of the market for sulphate of ammonia continues to improve somewhat. Sales have been made at very near to £12 15s. on Beckton terms, which price is the closing quotation.

LIVERPOOL, *April* 15.

Sulphate of Ammonia.

There has been good demand for prompt delivery, and all ready parcels have found buyers at last week's closing prices. There has also been a fair amount of business done for delivery within the month; and to-day's quotations are £12 11s. 3d. per ton f.o.b. Hull, £12 13s. 9d. per ton f.o.b. Liverpool, and £12 15s. per ton f.o.b. Leith. There has been considerable inquiry for near months, but buyers look for a substantial concession in this position; while makers are not much inclined to reduce prices, in face of a firm spot market. Sales are reported for July-December delivery at below £12 5s. per ton f.o.b., but particulars have not transpired. At the close there is large inquiry for July-December.

Nitrate of Soda.

The situation generally remains as last reported; but local prices have been advanced to 11s. 1½d. and 11s. 4½d. per cwt., according to quality.

LONDON, *April* 15.

Tar Products.

There has certainly been more inquiry, although as a rule prices are slightly easier all round. Some 90 per cent. benzol has been placed at 8¾d. f.o.b. London for April-June delivery; and consumers now decline to pay more than 8½d. for prompt, as there is no difficulty in securing supplies at 8d. in the North. In 50-90 per cent., there is still some quantity offering in the Manchester district; but distillers will certainly not accept the prices offered by consumers, which are, in their opinion, under the actual market value. There is still a fairly good inquiry for toluol, but there is practically nothing offering for prompt; while makers ask 8¼d. forward. In solvent, the position remains unchanged; but there is still a very good demand for the special qualities with a heavy specific gravity. There is nothing fresh to advise in anthracene, although it is reported that one of the largest London producers declined an offer made by German consumers for delivery all over next year. In carbolic acid, Continental buyers are purchasing

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freely at 1s. 9d. for April-June; while London makers report having realized 1s. 9½d. in several instances, and are asking 1s. 10d. up to the end of the year. Crystals continue fairly firm; and makers are not so anxious to sell as was the case a little while ago. There appears to be a general belief that the price of this article should improve, as makers do not hold any stocks and dealers are not now offering so freely at low prices. Creosote is decidedly quiet. Business is reported in the North of England at 1¼d.; while there is a rumour that even less than this has been accepted in one or two instances. So far as the Manchester district is concerned, consumers will not pay over 1⅛d.; and business is reported for early delivery at this price. In London, the largest makers are still fairly firm in their ideas; but consumers are not prepared to pay anything like the prices asked for either prompt or forward delivery. The future value of this article so far as London is concerned will, of course, almost entirely depend upon the American demand, which, it is understood, is likely to be fairly good for September-December delivery. Pitch still continues very dull; and there is really very little actual business doing. The largest London producers still quote 33s.; but considerably under this has been accepted by dealers during the past week, while in Yorkshire sales are reported at 30s. for prompt delivery in more than one instance. There does not seem to be any demand from Belgium for early delivery; while for forward the prices offered are quite out of proportion to manufacturers' ideas of future values. There is still considerable weakness in the Manchester and Liverpool district, and sales are reported at very low prices for early delivery; makers being evidently anxious to clear out stocks.

The average values during the week were: **Tar**, 17s. 6d. to 21s. 6d. **Pitch, London**, 31s. 6d. to 31s. 9d.; **east coast**, 30s.; **west coast**, 28s. to 28s. 6d. **Benzol, 90 per cent.**, 8¾d.; **50-90 per cent.**, 7½d. to 7⅝d. **Toluol**, 8d. **Crude naphtha**, 3d.; **solvent naphtha**, 8d. to 8¼d. **heavy naphtha**, 10d. to 10½d. **Creosote, London**, 1⅝d. to 1 1/16d.; **North**, 1¼d. **Heavy oils**, 2d. to 2⅛d. **Carbolic acid, 60 per cent.**, 1s. 9d. to 1s. 9½d. **Refined naphthalene**, £4 to £8; **salts**, 15s. to 17s. **Anthracene**, "A" quality, 1½d. to 1⅝d.; "B" quality, unsaleable.

Sulphate of Ammonia.

The market has been rather quiet; but there is still a good demand or prompt delivery. Beckton quote £12 15s., and are reported to have declined business at very little under this price; while the South Metropolitan's nominal quotation is still £13, although business is impossible at this figure. In Hull, business has been done during the week at £12 10s. for early delivery, and some makers ask £12 11s. 3d. and even £12 12s. 6d.; but consumers decline to pay these prices at present. In Leith, it is difficult to fix the actual value. Makers are undoubtedly very firm in their ideas, and will not accept anything under £12 15s.; while some are asking £12 16s. 3d. It is reported, however, that dealers are accepting slightly under these prices for early delivery, although very little actual business has taken place at the prices named.

COAL TRADE REPORTS.

Lancashire Coal Trade.

With the exception of a spirited demand for engine fuel of all kinds, the coal market possesses no features of special interest. House descriptions are in such moderate request that an effect has been produced in the coal mining industry which is somewhat dispiriting. Several of the collieries in this neighbourhood are only working four days per week, despite the great increase generally in the cotton and engineering trades of this and the adjoining counties. There is little expansion from this district in the way of export, although coal for the shipping on the Canal continues in fair demand; but at present it is a steady trade, with room for much further development. Quotations show no variation from our last published list.

Northern Coal Trade.

There is rather a fuller demand for coal, possibly because of the approach of the holidays in part, but also because of the nearing of the time for the beginning of the Baltic trade, which is so important in the coal industry of the North-east. Best Northumbrian steams are steady at from 9s. to 9s. 3d. per ton f.o.b., second-class steams are from 8s. 3d. to 8s. 6d. per ton, and steam smalls are generally firm at from 4s. 9d. to 5s. 3d. In gas coals, more of the contracts for the supply of the chief companies have been fixed; so that it may be said that the bulk of these have now been arranged for another period, and that on terms that are substantially the same as those of a year ago, though with an occasional reduction of 1d. or so per ton that may make the average price a little less to the buyers. For occasional cargoes the price is steady; good Durham gas coals varying from 7s. 9d. to 8s. 6d. per ton f.o.b., with a rather improving tendency in the values. One or two contracts are still running at 13s. per ton f.o.b. for good gas coke; but current quotations are often 9d. below this price.

Scotch Coal Trade.

There is still depression in the market, though a slightly larger volume of business is being done. Ell and splint are in rather better demand; and so is coal for iron-works, in connection with which it is reported that some good orders have come in. Complaint is being made that there is too keen competition among the collieries in the Lothians; and a combination is urged, in order to stiffen prices, which, at present, are very unremunerative. In this connection, it is stated that there is room for a considerable increase in the selling price, as prices will have to rise about 7d. per ton before there can be any demand by the miners for higher wages. The prices quoted are: Main, 7s. 3d. to 7s. 6d. per ton f.o.b. Glasgow, ell 7s. 9d. to 8s. 9d., and splint 8s. 3d. to 8s. 6d. The shipments for the week amounted to 214,261 tons—a decrease of 3873 tons upon the preceding week, but an increase of 27,092 tons upon the corresponding week of last year. For the year to date, the total shipments have been 2,946,963 tons—an increase of 314,118 tons upon the same period of 1904.

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London Office: 110, CANNON STREET, E.C.

TRADE NOTES.

Walker's Sulphate Plant with Rectangular Stills.

Messrs. C. & W. Walker, Limited, of Donnington, have obtained an order for four of their large-size sulphate of ammonia plants for erection in Great Britain. The combined plants are to treat 58,000 gallons of liquor per day, and are fitted with their latest form of rectangular still, with outside overflows and cleaning-out doors and self-discharging saturators.

Extended Use of Jager Grids.

We learn that the new Jager grid shops of Messrs. Samuel Cutler and Sons are very busy with plant for this system of purification; and that among new orders recently received are for installations of it at the gas-works in the following places: Edinburgh, Enfield, Westgate-on-Sea, Burnley, Bournemouth (new Poole works), Harrogate, &c. Messrs. Cutler and Sons have erected a large steam joinery, equipped with the most modern machinery, to be devoted exclusively to the manufacture of these grids.

The "Caxton" Lantern for Public Lighting.

The lantern which the Gas Committee of the Wigan Corporation have found so satisfactory in connection with the incandescent gas lighting of the town is the "Caxton," made by Mr. W. Edgar, of Blenheim Works, Hammersmith. We are informed that in the North of England this lantern has been employed in many cities and towns; and that within the last three months it has been erected in the streets of Congleton, Durham, North and South Shields, and Tynemouth. It has also been adopted for Cambridge.

The Cost of the Typhoid Epidemic at Lincoln.—The budget statement of the Lincoln City Council shows that the cost of the typhoid epidemic to the ratepayers already amounts to £4000; and the Corporation anticipate another £5000 expenditure during the financial year. This means a rate of nearly 4s. in the pound. To meet the outlay, £6000 has been appropriated from the gas and water profits.

Disposal of the Oil-Gas Plant at Southport.—The Gas Committee of the Southport Corporation have decided to dispose of the oil-gas plant at the Crowlands Gas-Works, which was put in at the time of the prevalent feeling in favour of gas of high illuminating power. At present, the Corporation have extensive water-gas plant, and the oil process being unnecessary, the space occupied in working it will be otherwise utilized.

Gas Profits at Stalybridge.—The Stalybridge Town Council have just received the gratifying intimation from the Chairman of the Gas Committee (Alderman Ridyard) that the working of the gas undertaking for the past twelve months has resulted in a profit of £3200. After paying £1000 towards the relief of the rates, there will be a credit balance of £4000. The Committee are considering the advisability of reducing the price of gas.

The Fatal Fire at Braddock's Meter Works.—A second death has unfortunately taken place in connection with the recent fire at the Globe Meter Works, Oldham—Messrs. J. & J. Braddock's branch of Meters Limited (*ante*, p. 40). The latest victim is William Shaw, a foreman, who was severely burnt, but lived until a week ago. In the case of the other man—a labourer—who died almost at once from his injuries, the inquest revealed that the fatality was due to the storekeeper striking a match near some turpentine casks.

Proposed Improvements at the Barrow Gas-Works.—A deputation consisting of members of the Gas and Water Committee of the Barrow Town Council recently visited Morecambe to inspect the gas-works, prior to improvements being carried out at Barrow, where, it appears, they are greatly needed. The matter was mentioned at the meeting of the Town Council on Monday last week, when Ulverston was pointed to as a place which might have been visited with more advantage than Morecambe, owing to the excellent results obtained there. However, the deputation will report the outcome of their visit.

Water Supply for Catisfield.—At a total cost of £4250, the Urban District Council of Fareham have extended their water supply to Catisfield, a charming little village which is destined to become a residential neighbourhood; and last Wednesday the new reservoir was utilized for the first time—the engines being started by Mr. John Sandy, the Chairman of the Council. They are capable of pumping 4000 gallons an hour; and the new reservoir at Red Barn, two miles distant from the works, will store 20,000 gallons. Mr. W. Butler, the Council's Surveyor, has superintended the extension of the works.

The Rejection of the Torpoint Water Bill.—At a meeting of the Torpoint District Council last week, the Chairman (Mr. T. E. Reynolds) referred to the rejection by the House of Lords Committee of the Water Bill presented by the Council, and said the Parliamentary Committee of the Council were deeply pained and disappointed with the result. They had again to face the question of providing an efficient supply; and the Council must bend their energies in this direction. It was decided to ask the Solicitors to attend a meeting of the Parliamentary Committee, and also a meeting of the Council, for the discussion of the matter.

Fire at the Bath Gas-Works.—On the morning of Sunday, the 9th inst., a sensation was created in Bath by an alarm of fire at the gas-works. Just after ten o'clock, it was noticed that flames were issuing from the sulphate and boiler house. The Bath and Weston Fire Brigades were quickly summoned, and a good supply of water was available from the mains. The firemen were kept hard at work for several hours, during which time the greater part of the roof and most of the woodwork of the shed were destroyed. No damage of importance was done to the plant. The premises were secure at six o'clock in the morning. The cause of the outbreak has not been discovered.

The Caistor Rural District Council have instructed Mr. E. J. Silcock, M.Inst.C.E., of Leeds, to prepare schemes of water supply for Middle Rasen and Waddingham.

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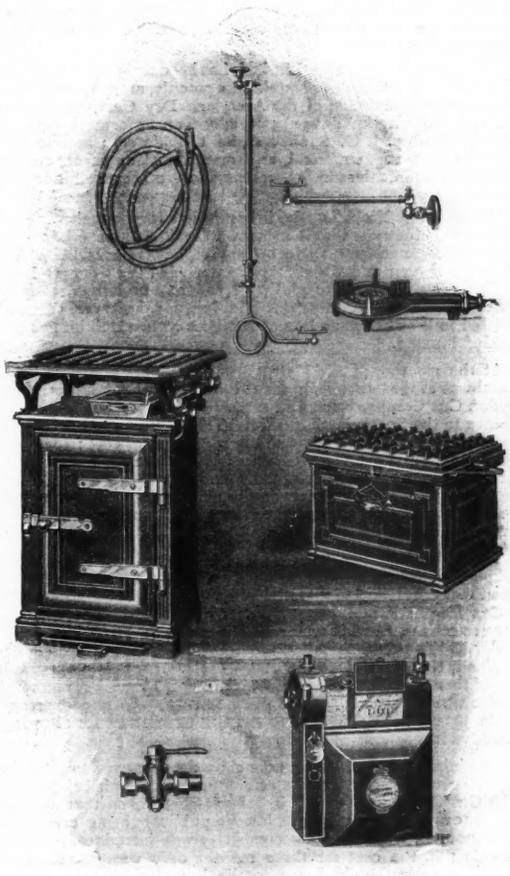
SLOT

INSTALLATIONS.



PARKINSON AND W. & B. COWAN, LTD.

(Parkinson Branch),

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The Kelty Gas Company, Limited, was registered in Edinburgh last week. The capital is £7000, in £1 shares. This is a new Company which is being formed to supply a mining district that is growing rapidly.

The Arnside Gas Company, Limited, has been registered with a capital of £5000, in £1 shares, to establish and carry on the business of a gas, coal, and coke company in and near the parish of Arnside, Westmoreland.

The Gilbert Little Company, Limited, has been registered with a capital of £5000, in £1 shares, to carry on the business of electrical, mechanical, mining, and general engineers, tool and boiler makers, founders, millwrights, machinists, metallurgists, manufacturers of, and dealers in, conveying machines, elevators, automatic feeding machinery, &c. There will be no initial public issue.

The exclusive speciality of Messrs. Peckett and Sons, of Bristol, is the manufacture of tank locomotives in every variety; and in an abridged illustrated list they are now sending out, they have made a selection of engines which they recommend as being best adapted for gas and other works where tractive power is needed. The list is of convenient size, and the engines shown are very effectively printed.

On the afternoon of last Saturday week, a large number of members of the Castlemere United Methodist Free Church Men's Society visited the Rochdale Gas and Electricity Works. The Gas Engineer, Mr. T. B. Ball, conducted them over the former, and lucidly explained the various processes. Subsequently he was heartily thanked for his services. A similarly instructive time was afterwards spent at the electricity works.

A fire broke out last Tuesday in one of the stills at Messrs. Sadler and Co.'s chemical works, at Ulverston; and the burning tar spread rapidly to four other stills. In spite of the efforts of the fire brigade, the flames travelled to the adjoining sheds and buildings; and these, with the whole of their contents, were destroyed. It is stated that, before the fire was got under, several thousand pounds' worth of damage had been done.

The Sun Gas Company, Limited, has been registered with a capital of £25,000, in £1 shares, to acquire the patents, undertaking, and other assets (except book debts) of the Acetylene Dry Generation and Residues, Limited (in liquidation); to adopt an agreement with the old Company and Mr. J. G. Saunders (the Liquidator); and to carry on the business of gas, electrical, and mechanical engineers and manufacturers of, and dealers in, gas-making and other machinery and appliances, &c.

Mr. S. Davis Nicholls, who is known to a large number of members of the gas industry, as well as to wholesale houses engaged in the mantle and incandescent trade in general, has resigned his position as Assistant-Manager and Chief Representative of the General Incandescent Company, Limited, of 56, City Road, and no longer retains a seat on the Board of the Company. He has not, however, ceased to be interested in the particular line of business with which he has hitherto identified himself.

At the meeting of the Metropolitan Asylums Board on Saturday, the seal was affixed to an agreement between the Managers and the Croydon Gas Company for the supply of gas for cooking and other purposes to the Southern Hospital. The Company undertake to lay a gas-main and service-pipe to the hospital free of cost; the Managers undertaking during seven years to pay for a minimum quantity of 730,000 cubic feet of gas annually, subject to graduated discounts (ranging from 2½ to 5 per cent. on the prices charged by the Company to private consumers) according to the quantity of gas consumed above the minimum.

The senior male class from the Portwood Wesleyan Sunday Schools, Stockport, about 24 in number, were conducted through the gas-works of the Stockport Corporation last Wednesday night by Mr. S. Meunier, the Gas Engineer, and his Assistant, Mr. Webb. The whole of the processes connected with making both coal and water gas were fully explained. The mechanics' and joiners' shops were inspected, and the tour also included an examination of the meter-testing apparatus. A letter of thanks was sent from the class to Mr. Meunier, recording the pleasure which the visit gave to the members, who also expressed the opinion that thanks were due to the Gas Committee for allowing such instructive inspections of the works.

The inhabitants of Ilfracombe should no longer have any doubtas to the relative cost of gas and electricity. A leaflet is being circulated by the Gas Company showing, in balance-sheet form, that in the neighbouring town of Barnstaple gas for the public lighting cost £1105 for twelve months, whereas when electricity was introduced, in conjunction with gas, the cost for three months only was £1016. To bring the matter more closely home to the householder, it is shown that one 16-candle "Bijou" gas-lamp, burning for 1000 hours, consumes 1000 cubic feet of gas, and costs 3s. 6d.; whereas an electric lamp of similar power burning for a like number of hours uses 62 units of electricity, which at 5½d. per unit costs £1 8s. 5d.

An exhibition of modern gas lighting, heating, and cooking appliances, together with a course of cookery lectures, was held by the Hertford Gas Company at St. Nicholas Hall from Tuesday to Friday last. The exhibition was opened on Tuesday afternoon, in the presence of a large company, by Mr. E. Manser, the Chairman of the Company. He said that in getting up the exhibition they were very much indebted to the Davis Gas-Stove Company, Limited, Messrs. Fletcher, Russell, and Co., Limited, and Messrs. Wilsons and Mathiesons, Limited, who had sent a large number of heating and cooking stoves. He introduced Miss Wilkinson, whom he described as a very able and clever exponent of cooking, and said he was sure those present would listen to her lecture with a great amount of pleasure. The hall was brilliantly lighted with four Keith high-pressure incandescent gas-lamps, which for less than 2d. per hour gave an intense illumination throughout the building. At the entrance gates was a similar lamp of nearly 1000-candle power, which was consuming less than 1½d. of gas per hour. The exhibition was organized and managed by Mr. H. D. Duesbury, the Manager and Secretary of the Company.

SEASON 1905.

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Slot Cookers

15 DIFFERENT SIZES.

Specially Designed for Hiring.

R. & A. MAIN, LIMITED,

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ALSO AT

FALKIRK, BIRMINGHAM, BRISTOL,
MANCHESTER, MELBOURNE, AND SYDNEY.

The Chemical Engineering Company and Wilton's Patent Furnace Company have received an order for the supply and erection of a sulphate of ammonia plant for the Wexford Gas Consumers' Company, Limited, as well as for one of their patent ammonia liquor stills, with automatic lime-pump, for the Hinckley Urban District Council.

Last week Messrs. Fletcher, Russell, and Co., in conjunction with the Lessees of the Stowmarket Gas-Works, held a local exhibition; cookery lectures and demonstrations being given each afternoon and evening by Miss Ada Ball. A feature of the exhibition was a display of Lucas high-power lamps.

WANTED, FOR SALE, CONTRACT, &c. ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

MANAGER AND ACCOUNTANT. Wellington (Salop) Gas-Works.
ASSISTANT RETORT-HOUSE FOREMAN. No. 4377.
TRAVELLERS. No. 4379.
CARBONIZING FOREMAN. Longton Gas Department. Applications by May 1.
MAIN AND SERVICE LAYER, &c. Seaford Gas-Works.

Pupil Wanted. No. 4382.

Tank Waggons to Let.

CLAYTON ANILINE COMPANY.

Situations Wanted.

GENERAL ASSISTANT. No. 4371.
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Plant, &c., for Sale.

CONDENSER. Redditch Gas Company.
MOUTHPIECES, HYDRAULIC MAINS, STATION METER, STATION GOVERNOR, RETORT, &c. Swadlincote Gas Department.
PURIFIERS, &c. Redditch Gas Company.

TENDERS FOR

Carbon.

WOOLWICH GAS FACTORY. Tenders by May 1.

Coal.

BRECHIN GAS DEPARTMENT. Tenders by April 22.
DENTON GAS DEPARTMENT. Tenders by April 29.
INVERNESS GAS DEPARTMENT. Tenders by April 25.
ULVERSTON GAS AND WATER DEPARTMENT. Tenders by April 27.

Condenser.

MARPLE GAS DEPARTMENT. Tenders by April 26.

Exhauster and Engine.

COLWYN BAY AND COLWYN GAS DEPARTMENT. Tenders by April 22.

Gasholder and Tank.

COALVILLE GAS DEPARTMENT. Tenders by May 1.

Gasholder Extension.

MARPLE GAS DEPARTMENT. Tenders by April 26.

Lime.

INVERNESS GAS DEPARTMENT. Tenders by April 25.

Purifiers.

MARPLE GAS DEPARTMENT. Tenders by April 26.

Purifying Plant Alterations.

TYLDESLEY-WITH-SHAKERLEY GAS DEPARTMENT. Tenders by May 1.

Roofs.

MARPLE GAS DEPARTMENT. Tenders by April 26.

Scrubber.

MARPLE GAS DEPARTMENT. Tenders by April 26.

Tar.

DENTON GAS DEPARTMENT. Tenders by April 29.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

EASTER HOLIDAYS.

In consequence of the EASTER HOLIDAY, all Communications for the next issue of the "JOURNAL" and Orders respecting ADVERTISEMENTS should be received at the Office NOT LATER than the FIRST POST ON SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
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PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Exchanged for Spent Oxide.
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BROTHERTON AND CO., LTD., Tar Distillers. Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, AND WAKEFIELD.

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SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
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ATTERTON'S Patent Charging Machine, especially adapted for Small Works up to 50 Millions. Nearly 40 already supplied, and still supplying. Would soon repay for small outlay. Increased make and reduction in cost.
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WANTED, a situation as General ASSISTANT on a Gas-Works. Served articles with Gas Engineer and Manager. Good Carbonizer, Analyst, and Draughtsman, and a thorough all-round knowledge of the General Routine of a Gas-Works. Five Years' Experience. Salary moderate. Would make appointment.
Address No. 4371, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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Send *copies* of Testimonials from last employer, and state Wages required and Age, to SECRETARY, Gas-Works, SEAFORD.

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THE above Company require a thoroughly experienced MANAGER and ACCOUNTANT.

Salary £240, with Coal and Gas. No House.

Apply for full Particulars and Duties to R. A. NEWILL, Esq., Secretary, Gas Company, Wellington, SALOP.

ASSISTANT RETORT-HOUSE FOREMAN.

WANTED, for a Provincial Works, a competent and reliable Man. Age not to exceed 30.

Apply, by letter, stating Experience, Wages expected, and enclosing *copies* of Two good recent References, to No. 4377, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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Apply, with not more than Three References, stating previous Experience and Age, not later than May 1, to

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WANTED, to sell Gas Coal, Two or Three Travellers who have good connection, and have sold largely to Gas Companies.

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(GAS DEPARTMENT.)

THE above Council have the following FOR SALE, cheap, for immediate removal.

28 ⊃ Retort MOUTHPIECES, 22-in. by 16-in., with Screws and Cross Bars, and Wrought-Iron Lids.

Two Wrought-Iron HYDRAULIC MAINS, ∪ shape, 2 ft. by 2 ft., for Four Beds of Seven Retorts. All Ascension, Bridge, and Dip Pipes 4-inches diameter.

Six BUCKSTAYS, TIE ROD, FURNACE DOOR, &c., complete, for above.

One Cylindrical STATION METER 10,000 feet per hour with Valves complete.

Two 8-inch STATION GOVERNORS, Valves, &c.

One ⊃ Clay RETORT 21 in. by 16 in. by 9 ft. long.

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G. B. SMEDLEY,
Engineer and Manager.

Gas-Works, Swadlincote.

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NOTICE OF REMOVAL.

THE Registered Offices of the above Corporation are being TRANSFERRED from "Conway Road, Penmaenmawr," to "Gas-Works, Holyhead," and all business communications to be addressed to the new address. This will avoid delay.

FOR Sale, cheap, a Wrought-Iron SCRUBBER, 20 ft. high by 3 ft. diameter, with 6-inch Valves and Connections.

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Apply to SAML. WHILE AND SON, 60, QUEEN VICTORIA STREET, E.C.

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J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

WAR DEPARTMENT CONTRACTS.

TENDERS are required for the Sale by the War Department of about 22 Tons of RETORT CARBON at the Gas Factory, Royal Arsenal, Woolwich, where it can be seen.

The Carbon will be loaded free into Trucks on the Royal Arsenal Railway Sidings, or in Barges alongside Royal Arsenal Wharves.

Forms of Tender will be issued on application to the Superintendent Building Works, Royal Arsenal, Woolwich, not later than Monday, the 1st day of May, 1905.

A. H. BAGNOLD, Colonel,
Supt. Building Works.

Royal Arsenal, Woolwich,
April 8, 1905.

DENTON URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

COAL.

THE Gas Committee invite Tenders for the supply of COAL; the same to be sent in on or before the 29th of April inst.

Specification and Form of Tender to be obtained from the Gas Engineer, Mr. J. Chadwick Smith, Gas-Works, Denton, near Manchester.

The Committee do not bind themselves to accept the lowest or any Tender.

By order,
WILLIAM RICHARDS,
Clerk of the Council.

April 15, 1905.

DENTON URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

TAR.

THE Gas Committee invite Tenders for TAR; the same to be sent in on or before the 29th of April inst.

Particulars may be obtained from the Gas Engineer, Mr. J. Chadwick Smith, Gas-Works, Denton, near Manchester.

The Committee do not bind themselves to accept the highest or any Tender.

By order,
WILLIAM RICHARDS,
Clerk of the Council.

April 15, 1905.

TYLDESLEY-WITH-SHAKERLEY URBAN DISTRICT COUNCIL GAS-WORKS.

THE above Council invite Tenders for ALTERATIONS to PURIFYING PLANT and the erection of SHEDS over same.

Particulars as to same may be obtained on application to Mr. R. H. Ginman, Engineer, Gas-Works, Tyldesley.

Tenders (on authorized Forms only, which can be obtained from the Engineer), sealed and endorsed "Purifiers, &c.," to be addressed to me and delivered at my Office not later than the 1st day of May, 1905.

The Council do not bind themselves to accept the lowest or any Tender.

By order,
W. J. MATTHEWS,
Clerk.

Council Offices, Tyldesley,
April 15, 1905.

ULVERSTON URBAN DISTRICT COUNCIL.

TENDERS FOR CANNEL.

THE Gas and Water Committee are pre- pared to receive TENDERS for best screened CANNEL for a period of One, Two, or Three Years commencing the 1st of July next.

Parties Tendering must give full Particulars of the Cannel they propose to supply, and name the pit from which the same will be raised.

Further Information and Forms of Tender may be obtained from the undersigned.

Sealed Tenders, endorsed "Tender for Cannel," and addressed to the Chairman of the Gas and Water Committee, to be sent in not later than the 27th inst.

The Committee do not bind themselves to accept the lowest or any Tender.

JNO. SWAN,
Engineer and Manager.

CONTRACT FOR COAL AND SHELL LIME.

THE Inverness Gas Commissioners are prepared to receive OFFERS for 8500 Tons of GAS COAL, to be delivered free at Inverness over a period of Six or Twelve Months, at the option of the Commissioners; also 350 Tons of SHELL LIME, to be delivered free at Inverness.

Tender Forms may be had by applying to the Manager at the Gas-Works.

Tenders, endorsed and addressed to Kenneth Macdonald, Esq., Clerk to the Commissioners, will be received up to Tuesday, the 25th curt.

Gas-Works, Inverness,
April 15, 1905.

COALVILLE URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

THE Chairman and Gas Committee of the above Council invite TENDERS for the supply of a Steel GASHOLDER and TANK, and its erection at the Gas-Works, Whitwick.

Specifications and Drawings may be seen, and Particulars to be had, by applying to Jos. W. Eagles, Gas Office, Whitwick.

The Committee do not bind themselves to accept the lowest or any Tender.

Tenders, endorsed "Gasholder," to be addressed to the Chairman on or before May 1, 1905.

JOS. W. EAGLES,
Manager.

BRECHIN GAS COMPANY.

TENDER FOR COALS.

THE Brechin Gas Company invite TENDERS for the supply of GAS COAL over the ensuing Year from the 1st of June.

300 Tons of Shale.
300 Tons of second-class Cannel.
2000 Tons of Splint, Gas and Coking Coals.

Coals in close proximity to Shipping Ports to be quoted f.o.r. at Montrose Harbour; others delivered free at Brechin Station.

Sealed Offers, marked "Tender for Coals," to be sent in not later than Saturday, the 22nd of April.

ALLAN REID,
Manager.

Gas-Works, Brechin, N.B.,
April 12, 1905.

URBAN DISTRICT COUNCIL OF COLWYN BAY AND COLWYN.

(GAS DEPARTMENT.)

THE Chairman and Gas Committee of the above Council invite TENDERS for the supplying and fixing, at the Gas-Works, Colwyn Bay, of a STEAM-ENGINE and ROTARY EXHAUSTER combined, capable of passing 30,000 cubic feet of Gas per hour.

Full Particulars to be had by applying to J. C. Pennington, Gas Offices, Colwyn Bay.

Tenders, endorsed "Engine and Exhauster," to be addressed to John Williams, Esq., Chairman of the Gas Committee, on or before the 22nd of April, 1905.

JNO. C. PENNINGTON,
Engineer and Manager.

MARPLE URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

THE Marple Urban District Council invite TENDERS for the supply of all or any of the following PLANT and APPLIANCES, delivered and erected at their Gas-Works, Marple Bridge:—

(*a*) Proposed New Outer-Lift to Existing Single-Lift Gasholder.
(*b*) New Wrought-Iron Annular Condenser.
(*c*) New Tower Scrubber.
(*d*) Four New Purifiers.
(*e*) Purifier-Shed Roof.

Plans and Specifications may be seen on application to Mr. J. R. Mackenzie, Gas Engineer to the Council, Marple Bridge, Nr. Stockport.

Tenders, endorsed as directed under each portion of the Plan, and addressed to the Chairman of the Council, to be sent to me before Ten o'clock a.m. on Wednesday, the 26th inst.

The Committee do not bind themselves to accept the lowest or any Tender.

By order,
CHARLES F. JOHNSON,
Clerk to the Marple Urban District Council.

Public Offices, Market Street,
Marple, April 11, 1905.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

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CHESTER 1st Order	J. Belton, Esq. ,,
CHESTER 2nd Order	,, ,,
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ENFIELD	Messrs. W. Valon & Son ,,
HULL	J. Holliday, Esq. ,,
HALSTEAD	J. Jolliffe, Esq. ,,
HARROGATE	G. Sayner, Esq. ,,
LEAMINGTON	T. Berridge, Esq. ,,
OLDHAM	T. Duxbury, Esq. ,,
ROCHESTER 1st Order	J. Veevers, Esq. ,,
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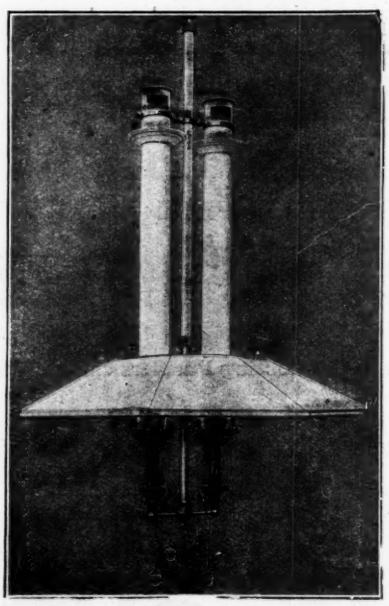

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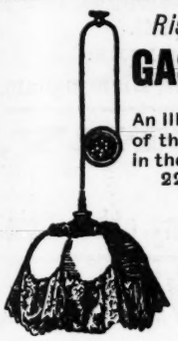

An Illustrated Description of this Pendant appeared in the "Journal" for Nov. 22, 1904 (page 599).

Write for full Particulars to the
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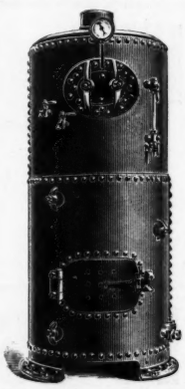

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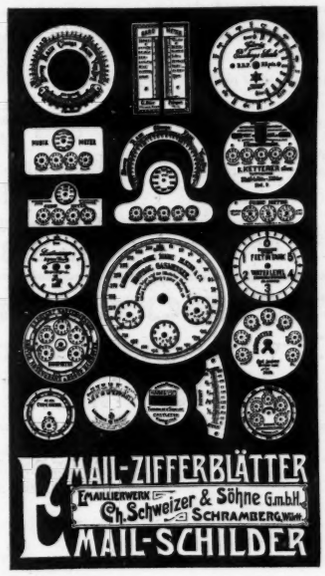

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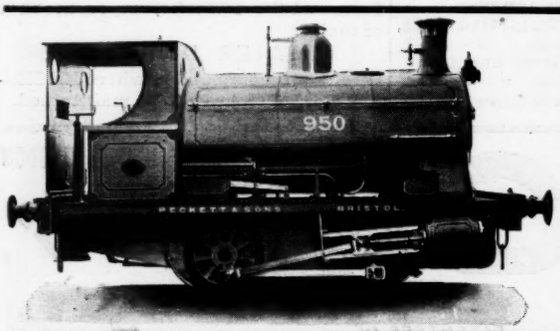

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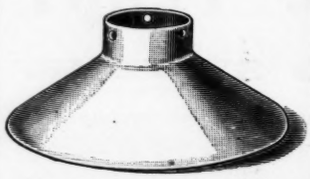

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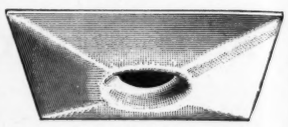

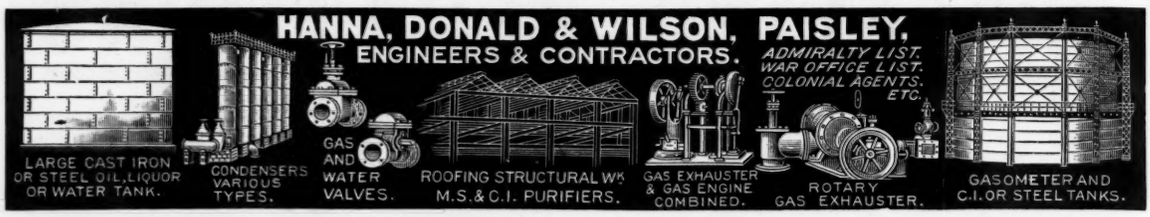
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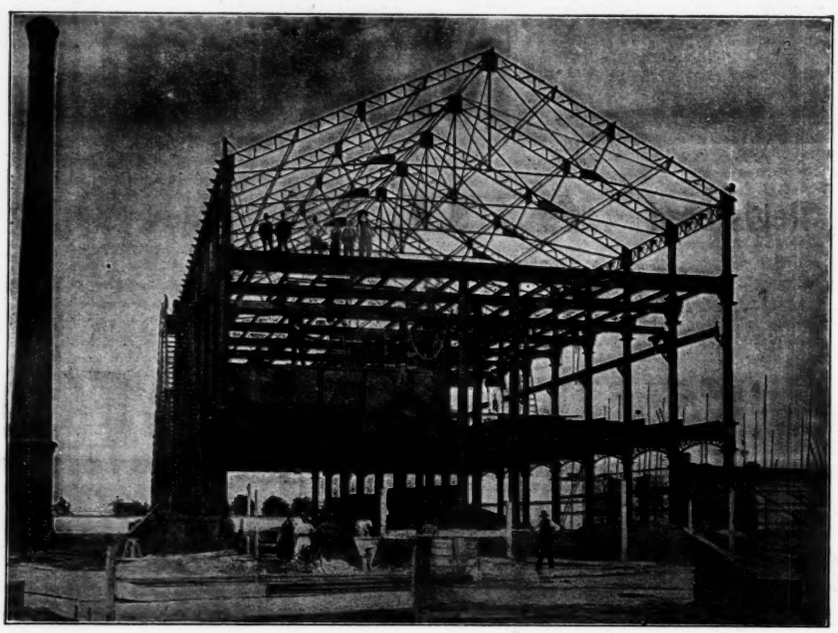

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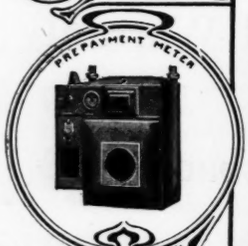

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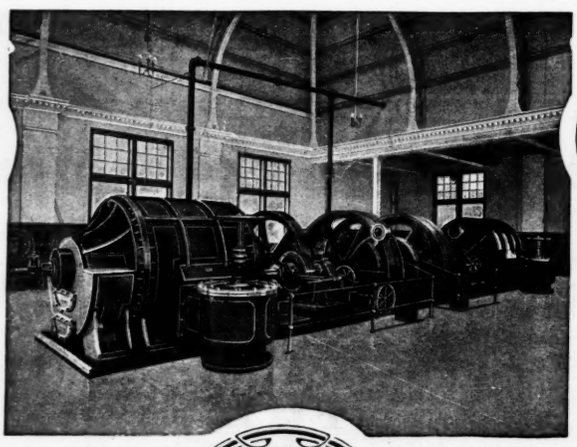

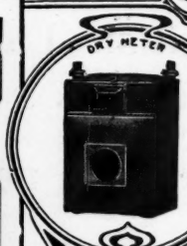

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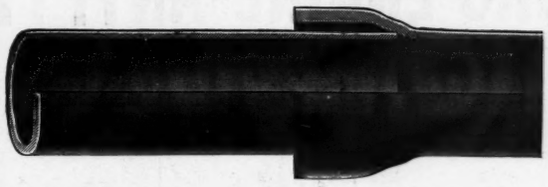

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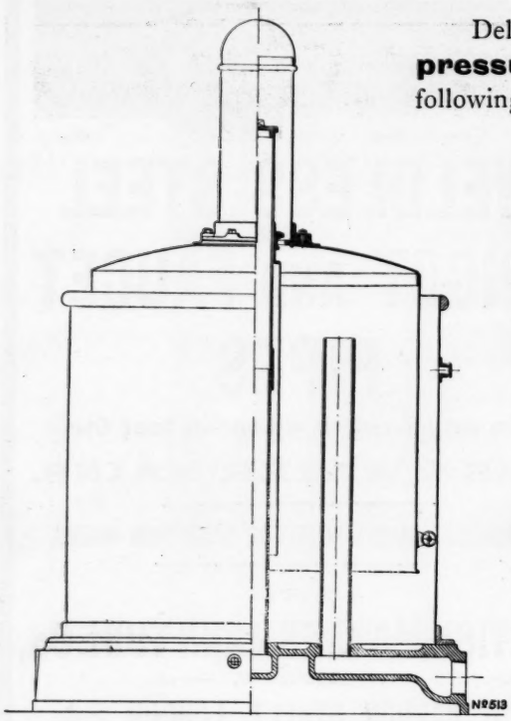

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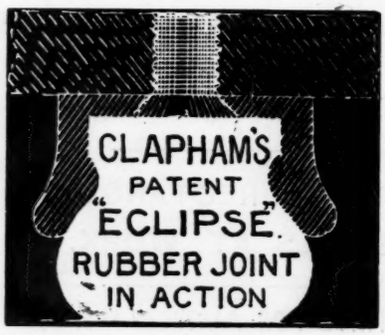

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